DEPARTMENT OF THE ARMY

EUROPE DIVISION, CORPS OF ENGINEERS

APO 09757

ENERGY ENGINEERING ANALYSIS PROGRAM

KAISERSLAUTERN COMMUNITY, FRG

EXECUTIVE SUMMARY

1 MAY 1984

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ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)
GLOSSARY OF TERMS AND ABBREVIATIONS
ENERGY REPORT

AAFES	-	ARMY AIR FORCE EXCHANGE SERVICE
ADMIN	-	ADMINISTRATION
AFCENT	-	ALLIED FORCES CENTRAL
AHU	-	AIR HANDLING UNIT
ASG	-	AREA SUPPORT GROUP
ASHRAE	-	AMERICAN SOCIETY OF HEATING, REFRIGERATION, AND AIR CONDITIONING ENGINEERS, INC.
AVG	-	AVERAGE
BAR	-	BAR: 14.5 PSI
BE	-	BELGIUM
BEQ	-	BACHELOR ENLISTED QUARTERS
BF	-	BELGIUM FRANC
BKS	-	BARRACKS
BLDG	-	BUILDING
BOQ	-	BACHELOR OFFICER'S QUARTERS
BTU	-	BRITISH THERMAL UNIT: A HEAT UNIT EQUAL TO THE AMOUNT OF HEAT REQUIRED TO RAISE ONE POUND OF WATER ONE DEGREE FAHRENHEIT.
BTU/HR OR BTUH	-	BRITISH THERMAL UNITS PER HOUR
C	-	CELSIUS
C & D	-	CHIEVRES & DAUMERIE
CFH	-	CUBIC FEET PER HOUR
CFM	-	CUBIC FEET PER MINUTE
CMU	-	CONCRETE MASONRY UNIT (BLOCK)
COMM	-	COMMISSARY

COMTY	-	COMMUNITY
CUFT	-	CUBIC FOOT
DA	-	DEPARTMENT OF THE ARMY
DD	-	DEGREE DAY: THE DIFFERENCE BETWEEN THE AVERAGE TEMPERATURE FOR A DAY AND 65° F.
DEH	-	DIRECTOR OF ENGINEERING AND HOUSING
DG	-	DUTCH GUILDER
DHW	-	DOMESTIC HOT WATER
DM	-	DEUTSCHE MARK
DOE	-	DEPARTMENT OF ENERGY
ECIP	-	ENERGY CONSERVATION INVESTMENT PROGRAM
ECO	-	ENERGY CONSERVATION OPPORTUNITY
ECOS	-	ENERGY CONSERVATION OPPORTUNITIES
EEAP	-	ENERGY ENGINEERING ANALYSIS PROGRAM
EFF	-	EFFICIENCY
EMCS	-	ENERGY MONITORING AND CONTROL SYSTEM
ESIR	-	ENERGY SAVINGS-TO-INVESTMENT RATIO
ESP	-	ENERGY SIMULATION PROGRAM
EUD	-	EUROPE DIVISION, CORPS OF ENGINEERS
F	-	FAHRENHEIT
FG	-	FIBERGLASS
FH	-	FAMILY HOUSING
FLUO	-	FLUORESCENT
FO	-	FUEL OIL
FRG	-	FEDERAL REPUBLIC OF GERMANY (WEST GERMANY)
FT	-	FEET
FUNC	-	FUNCTION
FY	-	FISCAL YEAR

GAL	-	GALLON
GPM	-	GALLONS PER MINUTE
GWB	-	GYPSUM WALL BOARD
GY AREA	-	GERMANY (GY) AREA
HGT	-	HEIGHT
HVAC	-	HEATING, VENTILATING, AIR CONDITIONING
KASER	-	KASERNE
KW	-	KILOWATT, 1000 WATTS
KWHR	-	KILOWATT HOUR
LAB	-	LABORATORY
LF	-	LINEAL FOOT
M	-	METER
M3	-	CUBIC METERS
MAN	-	MANUAL
MBTU	-	ONE MILLION BRITISH THERMAL UNITS
MEGA	-	MILLION
MH/MH	-	MAN-HOUR
MM	-	MILLIMETER
MO	-	MONTH
M & R	-	MAINTENANCE AND REPAIR
MUX	-	MULTIPLEX
MW	-	MEGAWATT, ONE MILLION WATTS
MWH	-	MEGAWATT-HOUR, ONE MILLION WATT-HOUR
MWHR	-	MEGAWATT-HOUR, ONE MILLION WATT-HOUR
MWHRS	-	MEGAWATT-HOUR, ONE MILLION WATT-HOURS
NATO	-	NORTH ATLANTIC TREATY ORGANIZATION
N/A	-	NOT APPLICABLE; NOT AVAILABLE

NBS	-	NATIONAL BUREAU OF STANDARDS
NE	-	NETHERLANDS
NL	-	NETHERLANDS
NOAA	-	NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NO.	-	NUMBER
NSSG	-	NATO SHAPE SUPPORT GROUP
OA	-	OUTSIDE AIR
OCCUP	-	OCCUPANCY
OH	-	OVERHEAD
OPER	-	OPERATIONS
O & M	-	OPERATION AND MAINTENANCE
PF	-	POWER FACTOR; RELATIONSHIP BETWEEN KW AND KVA. WHEN THE POWER FACTOR IS UNITY, KVA EQUALS KW.
PF	-	PFENNING
POMCUS	-	PREPOSITIONED MATERIAL CONFIGURED TO UNIT SETS
PSI(A)(G)	-	POUNDS PER SQUARE INCH (ABSOLUTE)(GAUGE)
PX	-	POST EXCHANGE
R-VALUE	-	THE RESISTANCE TO HEAT FLOW EXPRESSED IN UNITS OF (SQUARE FEET)(HOUR)(DEGREE F.)/BTU; R VALUE - 1/U VALUE.
SA	-	SUPPORT ACTIVITY
SF	-	SQUARE FOOT
SHAPE	-	SUPREME HEADQUARTERS ALLIED POWERS EUROPE
SIR	-	SAVINGS-TO-INVESTMENT RATIO: TOTAL LIFE CYCLE BENEFITS DIVIDED BY 90 PERCENT OF THE DIFFERENTIAL INVESTMENT COST.
SIOH	-	SUPERVISION, INSPECTION AND OVERHEAD
SOS	-	STATEMENT OF SERVICES
SP	-	SINGLE PANE
STY	-	STORY
TRY	-	TEST REFERENCE YEAR

'U' VALUE	-	A COEFFICIENT EXPRESSING THE THERMAL CONDUCTANCE OF A COMPOSITE STRUCTURE IN BTU PER (SQUARE FOOT) (HOUR) (DEGREE F. TEMPERATURE DIFFERENCE)
UA	-	OVERALL HEAT TRANSFER COEFFICIENT (BTU/HR DEGREE F.)
UPW	-	UNIFORM PRESENT WORTH FACTOR: A FACTOR, WHICH WHEN APPLIED TO ANNUAL SAVINGS, WILL ACCOUNT FOR THE TIME VALUE OF MONEY AND INFLATION OVER THE LIFE OF THE PROJECT.
US	-	UNITED STATES
USAREUR	-	UNITED STATES ARMY; EUROPE
V	-	VOLT
VET	-	VETERINARY
W	-	WATT
WDW	-	WINDOW
WHSE	-	WAREHOUSE
WK	-	WEEK
YR/yr	-	YEAR

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1. INTRODUCTION

1.1. Scope.

This Summary outlines documents the information compiled during Phase II of Contract DACA 90-83-C-0013, "Energy Engineering Analysis Program." A complete schedule of services is included as Appendix A to this report. The purpose of the contract is to reduce energy consumption in the community by identifying actions and/or projects that will accomplish this end. The contract is divided into three (3) phases:

1.1.1. Phase I - Data Gathering.

During this phase, data was compiled describing the pertinent features of energy consuming facilities and past history of energy consumption. This data is contained in the "Data Report" dated 15 April 1983.

1.1.2 Phase II - Data Analysis.

During this phase, the data collected in Phase I was analyzed. Energy conservation opportunities (ECOS) were identified and economically analyzed. The "Energy Report" presents recommendations, justifications, and preliminary DD Form 1391s.

1.1.3. Phase III - Project Documents.

During this phase, applicable DA Form 4283s, DD Form 1391s, and Project Development Brochures will be prepared.

1.2. General Description

The Kaiserslautern Military Community consists of 13 GYs located in and nearby the City of Kaiserslautern. This community is the home of the Headquarters of the 21st Support Command, Landstuhl Medical Center, and provides a broad range of functions including vehicle maintenance,

ordnance storage, communications, logistics and troop housing. GY 732, LAMC SATCOM and Heliport, GY 365 - Hill 365 and AFN Sembach were excluded from this survey because they have little manageable energy consumption.

1.2.1. Facilities.

* GY 072 Bann Communications Station is located on a hilltop about ten (10) miles southwest of downtown Kaiserslautern. Administrative space, technical facilities space, associated housing with mess, and storage space are provided in single story concrete or metal buildings.
* GY 298 Kaiserslautern Army Depot is located just east of the City. This, the largest US Army depot outside the states, includes receiving and shipping facilities, warehouses, vehicle maintenance facilities, computer and administrative spaces in single story metal or masonry buildings. Additional administration, housing, messing, and education facilities are single story modular wood buildings.
* GY 380 Kleber Kaserne is located on the east side of the City. It provides administrative space, troop housing and some community facilities, generally in multi-story concrete buildings.
* GY 382 Landstuhl Medical Facility is located about 10 miles west of downtown Kaiserslautern. This is a major medical center having a general hospital and the attendant support facilities.
* GY 455 Equipment Support Center is located at the east edge of Kaiserslautern. Its principal facilities are for vehicle repair.
* GY 490 Eselsfuerth Quarter Master Facility is located just northeast of the City. It includes warehouses, repair facilities, cold storage, a large laundry, and administration building. Generally, they are masonry construction and single story, except for the administration building and two 7-story warehouses.

* GY 542 Rhine Ordnance Barracks is located on the west edge of Kaiserslautern. Masonry buildings from one to three stories high provide administrative, education, troop housing and messing facilities. Metal buildings serve as warehouses, motor repair shops, and technical assembly buildings.

* GY 565 Panzer Kaserne is located adjacent to the 455th Equipment Support Center and is the site of the Headquarters of the 21st SUPCOM.

* GY 680 Daenner Kaserne and GY 741 Daenner Chapel are also located on the east side of Kaiserslautern. Daenner provides troop housing and administrative space in multi-story concrete buildings.

* GY 744 Pulaski Barracks is located on the west side of the City. It provides troop housing, messing facilities and administration space.

1.2.2. Location.

Kaiserslautern is located in West Central Germany. Approximately 90 km south and 50 km west of Frankfurt A.M. The general terrain in this area is hilly and wooded.

1.2.3. Climate.

Kaiserslautern is at the southern edge of the central highlands. Its climate is moderate. Summers are cool and winters are mild. Skies are generally overcast with frequent light precipitation. While the average winter temperature is approximately 40° F., spring and fall temperatures are also cool resulting in a relatively high number of annual degree-days. There is a weather station at nearby Sembach Air Base. Weather data for Sembach Air Base, FRG, is tabulated in TM 5-785 "Engineering Weather Data".

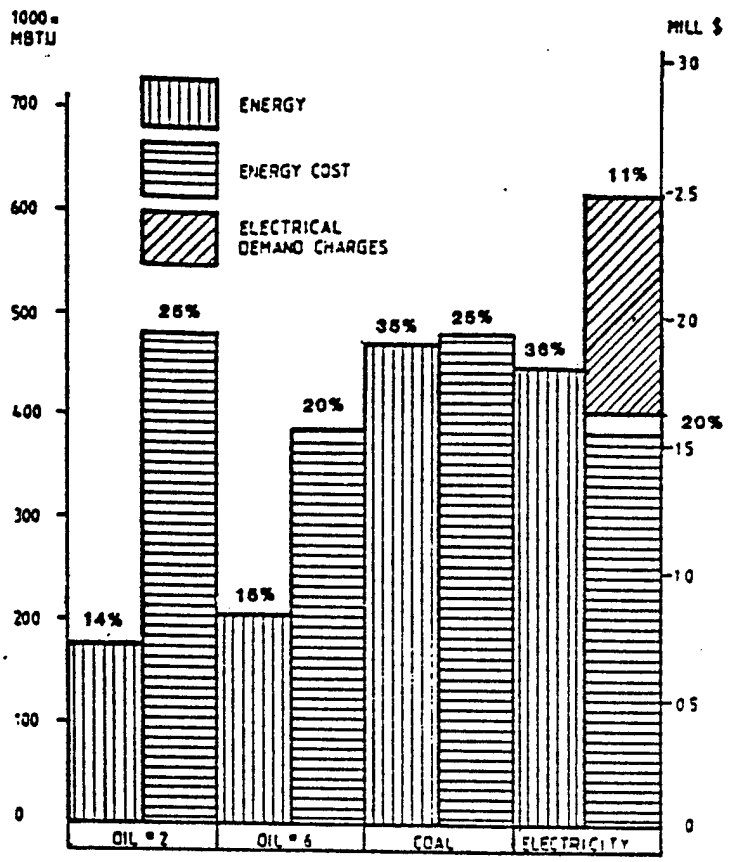
2. EXISTING ENERGY SITUATION

2. Source Energy Consumption.

The Kaiserslautern Community has consumed the following amount of fuel during the fiscal year of 1982 (FY 82).

	MBTU	%	$/MBTU	$	%
Thermal Energy:					
- Oil No. 2	184,783	(13.7)	10.45	1,930,982	(24.7)
- Oil No. 6	204,861	(15.2)	7.63	1,563,089	(19.9)
- Coal	467,606	(34.8)	4.11	1,921,861	(24.6)
TOTAL	857,250	(63.7)	22.19	5,415,932	(69.2)
Electrical Energy:	487,997	(36.2)	3.17	1,544,739	(19.7)
TOTAL	1,345,247	(100.0)		6,960,671	(88.9)
Electrical Demand Charges:	12,353 kW		$70./kW	864,710	(11.1)
GRAND TOTAL				7,825,381	(100.0)

The total energy situation as listed above is also shown in Diagram No. 2-1.



FY 82 ENERGY CONSUMPTION & COST

Diagram No. 2-1

2.2. Baseline FY 75 Energy Consumption.

No records are available for the FY 75 electrical energy consumption. The FY 75 data have been extrapolated from the FY 77 to FY 82 data obtained during site survey on the basis of Diagram No. 2-2.

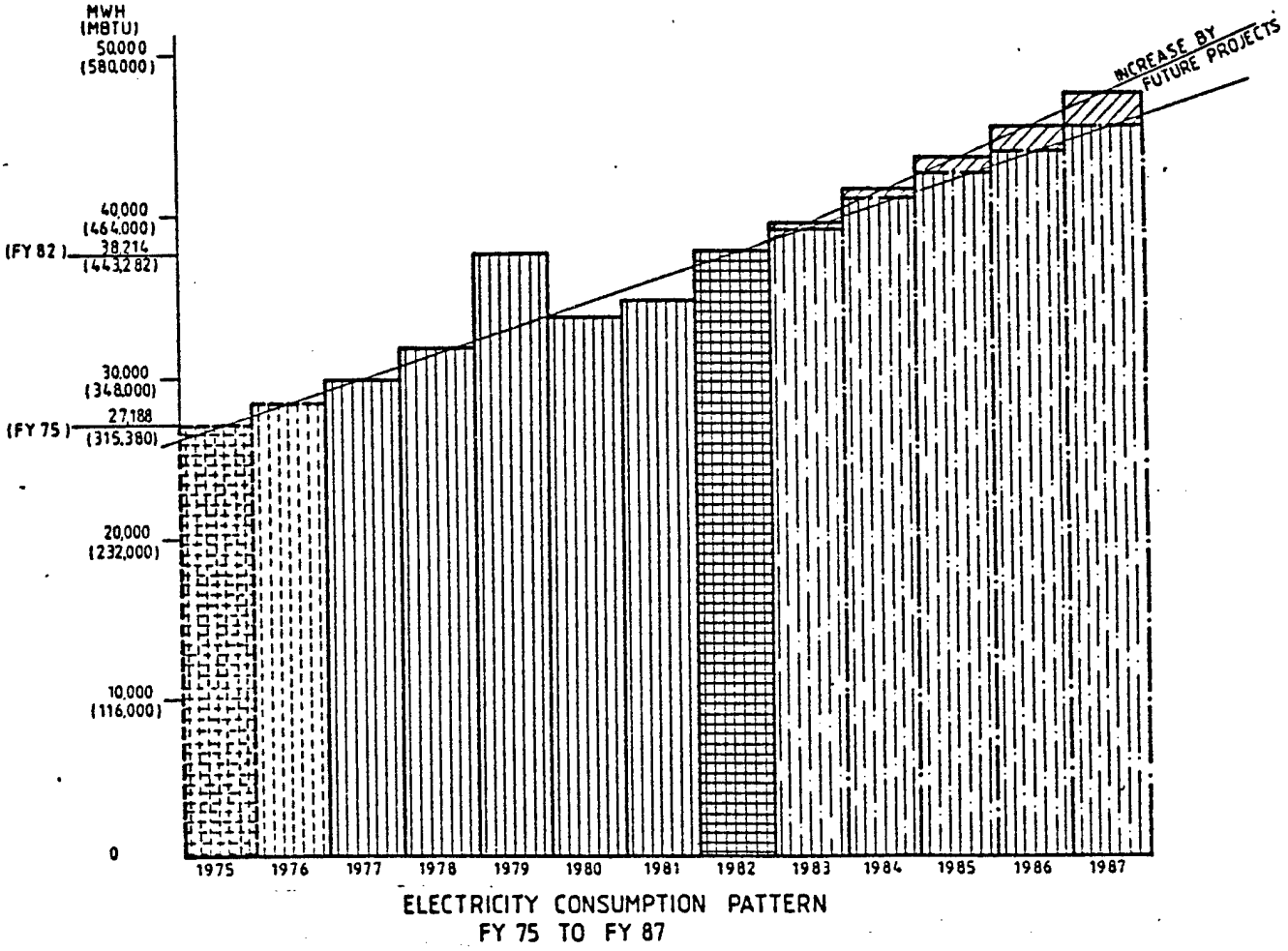
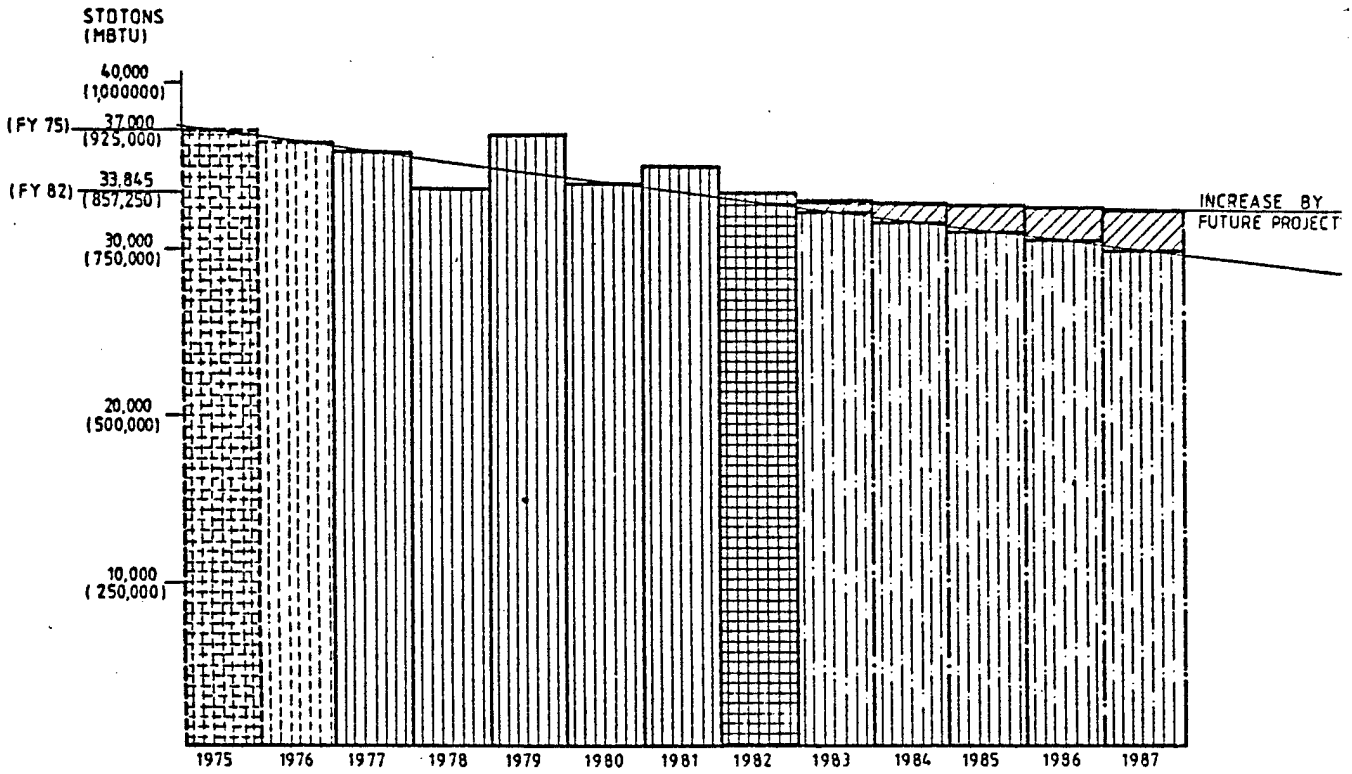


Diagram No. 2-2.

The thermal energy consumption was obtained during site survey and is shown in Diagram No. 2-3. This indicates also that the extrapolation of electrical energy is rather accurate.



FUEL CONSUMPTION PATTERN
FY 75 TO FY 87

Diagram No. 2-3

The costs have been calculated assuming an average increase of approximately 6 percent per year since FY 75, which results in an average of 4.25$/MBTU for thermal and 3.16$/MBTU for electrical energy. No separate records for different fuels are available.

	MBTU	$/MBTU	$
Thermal Energy	925,000	4.25	3,931,250
Electrical Energy	315,380	3.16	996,600
TOTAL	1,240,380		4,927,850
Electrical Demand Charges	8,788 kW	$47./kW	413,036
GRAND TOTAL			5,340,886

2.3. Present Annual Energy Consumption (FY 82).

Electricity.

The total electrical consumption for the Kaiserslautern Community in FY 82 was:

- Energy: 42,067 MWH = 487,997 MBTU
- Demand: 12,353 kW

Heating Fuel.

The heating fuel consumption is taken from "AERAS-FU Fact Sheet - Heating Fuel Conservation Program FY 82". The total FY 82 consumption was 33,845 STD TONS/a which is equal to 857,250 MBTU/a.

2.4. Existing Building Source Energy Consumption

2.4.1. Heating Demand.

A peak heating load was calculated for each building. With the peak heat load and degree-days from TM 5-785, the Modified Degree-Day Method can be used to estimate annual fuel consumption.

At the Kaiserslautern Community, 31 buildings were subjected to a computerized energy analysis using the computer program Energy Simulation Program II (ESP II).

All 31 buildings were simulated with the building envelope described as it presently exists. Table 2.1. on the following page is a tabulation of the modeled buildings, their peak heating loads in 1000's of BTUH (PHEAT1), Annual Energy Consumption in millions of BTU (AHEAT1) and RATIO1 = AHEAT1/PHEAT1/1000. A second simulation of each building was made revising the wall and roof materials in accordance with proposed weatherization projects. The results of these simulations are also shown in Table 2-1. as PHEAT2, AHEAT2, and RATIO2. While, for many buildings there is a dramatic reduction in peak heat and annual heating, there was no substantial change in the ratio of the two.

Table 2-1. Tabulation

BLDG	USE	PHEAT1	AHEAT1	RATIO1	PHEAT2	AHEAT2	RATIO2	COMM
2200	HQ ADM BLDG	1,086	3,217	2.96	687	2,141	3.11	A
2293	ADM GEN PURP	294	860	2.92	138	402	2.91	A
3004	ADM GEN PURP	548	1,339	2.44	353	736	2.08	A
3413	SUP SVC ADM	412	1,267	3.07	185	559	3.02	A
3101	ADM & SUP / BK	630	1,937	3.07	358	1,012	2.82	A
3107	ADM GEN PURP	378	1,021	2.70	171	435	2.54	A
3403	FIXED LAUNDRY	1,470	4,630	3.14	544	1,782	3.27	C
3243	ENL PERS MESS	295	800	2.71	185	487	2.63	F
163	ENL PERS MESS	389	1,094	2.81	157	454	2.89	F
2421	EM BK W/O MS	233	736	3.15	149	478	3.20	H
3200	EM BK W/O MS	2,203	6,598	2.99	1,065	3,285	3.08	H
3209	EM BK W/O MS	738	2,307	3.12	492	1,492	3.03	H
3246	EM BK W/O MS	591	1,912	3.23	385	1,221	3.17	H
162	EM BK / BN HQ	518	1,588	3.06	372	1,112	2.98	H
282	EM BK W/O MS	104	344	3.30	73	240	3.28	H
2925	EM BK W/O MS	384	1,226	3.19	224	739	3.29	H
3821	SEBQ	206	473	2.29	85	238	2.80	H
3763	HOSPITAL	388	967	2.49	234	506	2.16	K
2288	CARE & PRES SH	737	2,153	2.92	360	986	2.73	M
2233	ENG FLD MNT	5,323	15,343	2.88	3,869	10,590	2.73	M
3254	MOTOR REP SHOP	708	2,241	3.16	359	1,165	3.24	M
3041	MOTOR REP SHOP	986	2,398	2.43	682	1,464	2.14	M
3043	MOTOR REP SHOP	433	1,255	2.89	302	869	2.87	M
3050	MOTOR REP SHOP	276	806	2.92	172	500	2.90	M
3009	MOTOR REP SHOP	234	688	2.94	127	366	2.88	M
3401	QM REPAIR SHOP	1,359	4,019	2.95	533	1,490	2.79	M
3114	MOTOR REP SHOP	602	1,719	2.85	267	783	2.93	M
2292	EAM BLDG	258	740	2.86	116	308	2.65	O
3809	LAB/ADM/EM BK	1,425	3,734	2.62	616	1,637	2.65	O
2281	GEN PURP WHSE	2,579	7,244	2.80	2,088	5,810	2.78	S
3055	GEN PURP WHSE	694	2,043	2.94	398	1,164	2.92	S

To obtain the ratio of annual heat to peak heat for the non-modeled buildings, the modeled buildings were grouped by use and the average value for the group (omitting the highest and lowest) was used. In this manner, the following "equivalent full load hours" were obtained:

- Administration	2800	Use Code = A
- Community Facilities	2890	Use Code = C
- Troop Housing	3130	Use Code = H
- Medical	2490	Use Code = K
- Operations/Training	2590	Use Code = O
- Dining	2760	Use Code = F
- Maintenance	2905	Use Code = M
- Supply	2870	Use Code = S

2.4.2. Electrical Systems.

The Kaiserslautern Community is being supplied with electrical energy from two (2) power companies.

- Platzworks supply:

  GY 072 Bann, with a separate metering station.

  GY 382 Landstuhl Hospital, with a separate metering station.

  GY 542 Rhine Ordnance, and

  GY 744 Pulaski Barracks, with a common metering station "Kaiserslautern-West"

- Stadtwarke Kaiserslautern supply through two metering stations "Kaiserslautern-East I" and "Kaiserslautern-East II"

  GY 298 Army Depot

  GY 380 Weber Kaserne

  GY 455 Equipment Spl. Center

  GY 490 Eselsfuerth QM Facility

GY 527 Radio Relay Hill 365

GY 565 Panzer Kaserne

GY 680 Daenner Kaserne

An accurate separation of the two systems by GY for East I and East II is not possible, because GY 298 Army Depot is being supplied through both of these metering stations. For this reason, the GYs could only be grouped together as shown on Tables 2-101 to 2-105.

METERING STATION : GY 072 BANN
TABLE Nº 2-101

	LIGHTING	WTR. HTR.	FURNACE	RANGE	DRYER	WASHER	REFRIG. FREEZER	PUMP/FAN AC	OTHERS	TOTAL INST. KW	
GY 072 (KW)	4	22							180	206	
OPERATING HOURS	4,500	1,825							4.294		
ANNUAL CONS. (MWH)	18	40							773	831	
DEMAND (KW)	2.7	15							122.3	140	

METERING STATION : GY 382 LANDSTUHL HOSPITAL
TABLE Nº 2-102

	LIGHTING	WTR. HTR.	FURNACE	RANGE	DRYER	WASHER	REFRIG. FREEZER	PUMP/FAN AC	OTHERS	TOTAL	
GY 382 (KW)	1,085	102	46	192	175	43	240	134	1,897	3,914	
OPERATING HRS	3,325	1,825	2,190	1,460	1,460	1,095	1,095	3,650	995.3	/	
ANNUAL CONS. (MWH)	3,607	186	101	280	256	47	263	489	1,888	7,117	
DEMAND (KW)	486	46	21	86	78	19	108	60	850	1,754	

METERING STATION : WEST
TABLE Nº 2-103

	LIGHTING	WTR. HTR.	FURNACE	RANGE	DRYER	WASHER	REFRIG. FREEZER	PUMP/FAN AC	OTHERS	TOTAL INSTALLED (KW)	TOTAL TRANSF. CAPACITY (KVA)
GY 542 SURVEYED	455	71	102	61	77	14	40	625*	268	1713	
NOT SURVEYED	51	71					40	225	268	655	
FENCE LTG	230									230	6,065
AREA LTG	1200									1200	
COLD STORAGE							1047			1047	
GY 744	226	139	19	138	63	13	78	100	221	997	815
SUB TOTAL	2,562	281	121	199	140	27	1205	550	757	5,842	
AIR FORCE	90	9	15	18	15	3	90	38	48	326	
FREQU. CONV.								180		180	
TOTAL (KW)	2252	290	136	217	155	30	1795	1168	805	6,348	6,880
OPERATING HOURS	2,190	1,825	2,190	1,460	1,460	1,895	1,095	2,368	1,305		
ANNUAL CONS. (MWH)	4938	529	298	317	226	57	1,418	2694	1,051	11,522	
DEMAND (KW)	2107	274	128	205	147	28	1,224	1126	761	6,000	

* Includes elec. dehumidifiers.

METERING STATION : EAST I + II

TABLE Nº 2·104

	LIGHTING	WTR. HTR.	FURNACE	RANGE	DRYER	WASHER	REFRIG. FREEZER	PUMP/FAN AC	OTHERS	TOTAL	TOTAL TRANSF. CAPACITY (KVA)
GY 298	756	167	115	89	8	2	115	380	1491	3,123	5,890
GY 380	547	26	145	107	274	77	124	105	178	1,583	2,490
GY 455.	198	100	14	24			11	186	464	997	800
GY 490	146	24	5	7			68	18	320	588	1315
GY 527	28	3	2	3	6	1	1	10	46	100	160
GY 565	365.	62	30	16		4	14	40	151	682	1515
GY 680	202	64	82	133	234	40	11	38	35	839	630
TOTAL KW	2,242	446	393	397	522	124	344	777	2,685	7,912	12,800
OPERATING HOURS	3005	1825	2190	1460	1460	1085	1095	5840	1,477		
ANNUAL CONS. MWH	6,737	813	861	553	762	136	377	4,538	3,967	18,744	
DEMAND KW	1,264	251	221	214	294	70	194	438	1,513	4,459	

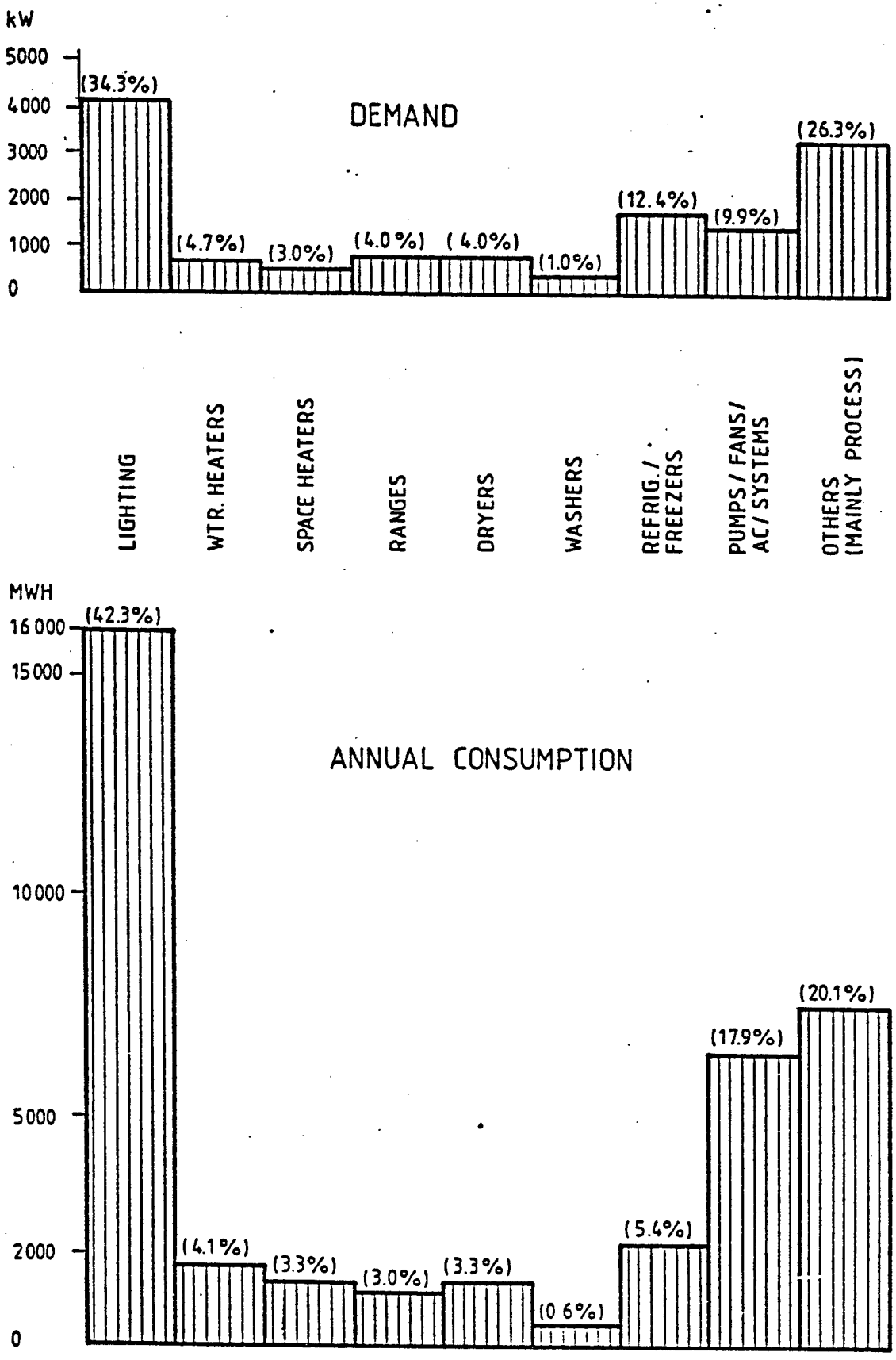
METERING STATION : TOTAL COMMUNITY
TABLE Nº 2-105

	LIGHTING	WTR. HTR.	FURNACE	RANGE	DRYER	WASHER	REFRIG. FREEZER	PUMP/FAN AC	OTHERS	TOTAL	
GY 072 *											
INSTALLED KW	4	22							180	206	
DEMAND KW	3.0	15							122	140	
ANNUAL CONS. MWH	18	40							773	831	
GY 382											
INSTALLED KW	1,085	102	46	192	175	43	240	134	1,897	3,914	
DEMAND KW	486	46	21	86	78	19	108	60	850	1,754	
ANNUAL CONS. MWH	3,607	186	101	280	256	47	263	489	1,888	7,117	
WEST-RING											
INSTALLED KW	2,652	290	136	217	155	30	1,295	768	805	6,348	
DEMAND KW	2,507	274	128	205	147	28	1,224	726	761	6,000	
ANNUAL CONS. MWH	5,808	529	298	317	226	57	1,418	1,818	1,051	11,522	
EAST-RING											
INSTALLED KW	2,242	446	393	379	522	124	344	777	2,685	7,912	
DEMAND KW	1,264	251	221	214	294	70	194	438	1,513	4,459	
ANNUAL CONS. MWH	6,737	813	861	553	762	136	377	4,538	3,967	18,744	
TOTAL INST. KW	5,983	860	575	788	852	197	1,879	1,679	5,567	18,380	
TOTAL DEMAND KW	4,260	586	370	505	519	117	1,526	1,224	3,246	12,353	
TOTAL CONS. MWH/a	16,170	1,568	1,260	1,150	1,244	240	2,058	6,845	7,679	38,214	
MWH/a %	42,3	4,10	3,3	3,0	3,3	0.6	5.4	17.9	20.1	100	
KW %	34.30	4.70	3.0	4.0	4.0	1,0	12.40	9.90	26.30	100	

* Installed KW = Connected Load

The basis used for these tables are the monthly "Electricity-Consumption-Load and Cost" FY 82 prepared by 80th TFW DEEE-U for the actual metered energy consumption and the demands, and also the survey data obtained during site survey in early 1983. This survey data is rather accurate because the individual electrical consumers used were obtained for each building and not only for the "survey/modelled" buildings.

Based on these information, the FY 82 load profiles are calculated as shown on tables 2-101 to 2-105 and indicated on Diagram No. 2-4.



FY 82 ELECTRICAL PROFILE

Diagram No. 2-4.

3. ENERGY CONSERVATION OPPORTUNITIES DEVELOPED

3.1. ECOs Investigated.

3.1.1. Individual Building ECOs.

Evaluation of ECO relating to building envelope, HVAC and lighting resulted in the following projects qualifying under ECIP criteria:

PROJECT DESCRIPTION	COST	ANNUAL SAVINGS (MBTU)	US$	SIR
Weatherization Walls and Roofs	$6,741,355	167,701	826,642	1.61
Heating System Modification	806,790	185,243	904,937	14.9
Lighting System Modification	1,163,065	30,278	206,575	1.95

3.1.1.1. Weatherization Projects.

During the field survey, 21 different types of walls and 30 different types of roofs were identified (see Data Report). Each wall and roof type was analyzed and a modification for each was proposed to (wherever practical) achieve "U" factors required by current criteria. Cost estimates were developed for each modification. Unit prices and revised "U" factors were used to compute costs and savings. Savings were reduced by the percentage savings already attributed to the mechanical control ECOs. All buildings having SIRs less than 1.0 were eliminated. All storm window/double glazing projects had SIRs less than one (1).

The wall and roofs modifications having SIRs equal to or greater than one (1) are shown in Tables 3-1 and 3-2 respectively. While wall and roof insulation has been combined into a single insulation project, walls and roofs in the same building do not necessarily always qualify economically and therefore are listed separately.

Total Annual Savings:

	HEAT MBTU	FUEL*
Savings -		
Walls		
Heavy Oil	3,498	4,373
Coal	2,048	2,926
Light Oil	3,507	5,010
Total	9,053	12,309
Roofs		
Heavy Oil	36,906	46,133
Coal	51,526	73,609
Light Oil	24,955	35,650
Total	113,387	155,392
TOTAL WALL AND ROOFS	122,440	167,701

* Fuel consumption based on 80 percent for heavy oil; 70 percent efficiency for coal and light oil.

Cost -	
Walls	212,600
Roofs	6,887,300
Total	7,099,900

SIR = 1.61

Table 3-1. Savings Weatherization Walls, Kaiserslautern

BLDG	KASERNE	FUNCTION	WALL TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT WALL
2615	GY 072	EM BK W/MES	CMU5	3,598	90	10,708	10,247	1.04	NO 2	2,672
2213	GY 298	INFL MAT ST	MET1	10,147	682	69,165	6,364	10.86	NO 6	7,217
2227	GY 298	GEN PURP WH	CAB1	3,014	35	3,643	2,857	1.27	NO 6	2,866
2256	GY 298	MIL BRIDGE	MET1	10,147	760	77,147	7,013	10.99	NO 6	7,953
2267	GY 298	BOX & CRATE	CMU1	15,183	319	32,386	11,533	2.80	NO 6	10,555
2289	GY 298	GEN PURP WH	MET1	31,360	1,700	172,398	15,864	10.86	NO 6	17,990
2300	GY 298	GEN PURP WH	MET1	5,319	401	47,692	3,746	12.73	NO 2	4,248
3251	GY 380	MOTOR REP S	MET1	9,835	887	56,160	8,178	6.86	COAL	9,275
3717	GY 382	STHS / AUTO	CMU2	8,068	227	14,413	9,441	1.52	COAL	8,640
3719	GY 382	GEN STOREHO	CMU2	8,002	193	12,218	8,100	1.50	COAL	7,413
3416	GY 490	GEN PURP WH	MET1	12,163	737	87,581	6,879	12.73	NO 2	7,801
150	GY 542	GEN PURP WH	CMU2	41,667	483	57,412	20,281	2.83	NO 2	18,561
310	GY 542	MOTOR REP S	CONC1	4,323	222	26,389	18,564	1.42	NO 2	4,842
646	GY 542	MOTOR REP S	MET1	4,332	364	23,063	3,358	6.86	COAL	3,809
695	GY 542	CHEMISTRY L	CONC1	4,595	577	68,576	45,461	1.50	NO 2	11,857
3019	GY 565	ADM GEN PUR	CMU1	2,815	90	5,720	3,174	1.80	COAL	2,905
3029	GY 565	QM REPAIR S	CMU1	30,041	489	58,173	17,683	3.28	NO 2	16,183
2850	GY 744	GEN PURP WH	MET1	2,135	223	26,576	2,087	12.73	NO 2	2,367
2855	GY 744	MOTOR REP S	MET1	2,618	283	33,625	2,609	12.88	NO 2	2,959
2859	GY 744	MOTOR REP S	CMU2	11,111	284	18,000	11,790	1.52	COAL	10,790

TOTAL ANNUAL HEAT SAVINGS MBTU	9,053
TOTAL DOLLAR SAVINGS	901,056
TOTAL COST	215,238
TOTAL SQFT	220,473
TOTAL SQFT WALLS	160,909
PEAK LOAD REDUCTION	3,135,158

Table 3-2. Savings Weatherization Roofs, Kaiserslautern

BLDG	KASERNE	FUNCTION	ROOF TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT ROOF
2615	GY 072	EM BK W/MES	RF1	3,598	247	29,376	9,171	3.20	NO 2	3,597
2618	GY 072	OPS GEN PUR	RF19	1,622	43	5,196	2,491	2.08	NO 2	1,624
2619	GY 072	READY BLDG	RF19	2,289	61	7,315	3,508	2.08	NO 2	2,287
2200	GY 298	HQ ADM BLDG	RF20	37,486	864	87,686	45,966	1.90	NO 6	37,466
2213	GY 298	INFL MAT ST	RF5	10,147	1,177	119,372	26,377	4.52	NO 6	10,345
2219	GY 298	GEN PURP WH	RF22	32,262	698	70,783	70,015	1.01	NO 6	32,904
2225	GY 298	CML FLD MT	RF2	10,770	664	67,414	19,375	3.47	NO 6	10,985
2226	GY 298	CARE & PRES	RF22	13,540	296	30,083	29,398	1.02	NO 6	13,815
2227	GY 298	GEN PURP WH	RF18	3,014	212	21,505	12,590	1.70	NO 6	3,012
2233B	GY 298	ENG FLD MNT	RF2	60,818	2,298	233,078	66,987	3.47	NO 6	37,982
2238	GY 298	GEN PURP WH	RF22	19,569	421	42,706	42,242	1.01	NO 6	19,852
2239	GY 298	GEN PURP WH	RF9	29,322	717	85,208	63,307	1.34	NO 2	29,751
2246	GY 298	OPS GEN PUR	RF7	4,165	106	12,667	9,043	1.40	NO 2	4,250
2256	GY 298	MIL BRIDGE	RF5	10,147	1,192	120,890	26,391	4.58	NO 6	10,351
2257	GY 298	GEN PURP WH	RF7	10,137	249	25,303	22,025	1.14	NO 6	10,351
2258	GY 298	GEN PURP WH	RF22	29,322	631	64,001	63,307	1.01	NO 6	29,751
2260	GY 298	GEN PURP WH	RF9	29,322	717	85,208	63,307	1.34	NO 2	29,751
2267	GY 298	BOX & CRATE	RF22	15,183	332	33,714	32,947	1.02	NO 6	15,483

Table 3-2. Savings Weatherization Roofs, Kaiserslautern (continued)

BLDG	KASERNE	FUNCTION	ROOF TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT ROOF
2276	GY 298	ADM GEN PUR	RF25	8,094	211	21,407	12,409	1.72	NO 6	8,091
2279	GY 298	ADM GEN PUR	RF25	6,633	172	17,535	10,164	1.72	NO 6	6,628
2281	GY 298	GEN PURP WH	RF22	72,226	1,562	158,487	156,768	1.01	NO 6	73,673
2288	GY 298	CARE &PRES	RF9	21,736	540	54,845	47,165	1.16	NO 6	22,165
2289	GY 298	GEN PURP WH	RF5	31,360	3,640	369,103	81,560	4.52	NO 6	31,989
2292	GY 298	EAM BLDG	RF20	12,105	258	26,205	14,851	1.76	NO 6	12,105
2293	GY 298	ADM GEN PUR	RF20	10,170	234	23,797	12,475	1.90	NO 6	10,168
2300	GY 298	GEN PURP WH	RF5	5,319	696	82,764	15,609	5.30	NO 2	6,122
2303	GY 298	CARE & PRES	RF11	5,525	308	36,678	8,465	4.33	NO 2	5,519
2306	GY 298	CARE & PRES	RF7	10,147	268	31,908	22,071	1.44	NO 2	10,372
2324	GY 298	GEN PURP WH	RF9	29,322	717	85,208	63,307	1.34	NO 2	29,751
2328	GY 298	GEN PURP WH	RF7	7,924	195	23,205	17,240	1.34	NO 2	8,102
2329	GY 298	CARE & PRES	RF5	11,703	1,378	163,719	30,506	5.36	NO 2	11,965
2346	GY 298	SALV & SURV	RF25	3,200	82	9,764	4,966	1.96	NO 2	3,238
2374	GY 298	ADM GEN PUR	RF29	5,058	321	32,584	13,168	2.47	NO 6	5,164
2384	GY 298	ADM GEN PUR	RF25	5,058	131	15,675	7,755	2.02	NO 2	5,057
2385	GY 298	GEN PURP WH	RF7	21,344	525	62,465	46,409	1.34	NO 2	21,810
2388	GY 298	GEN PURP WH	RF7	9,963	245	29,183	21,682	1.34	NO 2	10,189
2389	GY 298	GEN PURP WH	RF9	10,557	260	26,382	22,964	1.14	NO 6	10,792
2394	GY 298	MOTOR REP S	RF2	6,017	372	37,767	10,854	3.47	NO 6	6,154
2408	GY 298	EM BK W/O M	RF25	7,227	243	24,704	11,079	2.22	NO 6	7,224
2409	GY 298	ADM GEN PUR	RF25	2,393	62	6,319	3,663	1.72	NO 6	2,388
2410	GY 298	GEN INST BL	RF25	3,006	72	7,346	4,603	1.59	NO 6	3,002
2411	GY 298	EM BK W/O M	RF25	7,227	243	24,704	11,079	2.22	NO 6	7,224
2412	GY 298	EM BK W/O M	RF25	7,227	243	24,704	11,079	2.22	NO 6	7,224
2414	GY 298	SUP SVC ADM	RF25	2,393	62	6,319	3,663	1.72	NO 6	2,388
2418	GY 298	ADM GEN PUR	RF25	2,393	62	6,319	3,663	1.72	NO 6	2,388
2419	GY 298	SUP SVC ADM	RF25	2,672	69	7,059	4,092	1.72	NO 6	2,668
2420	GY 298	ADM & EM BK	RF25	7,227	188	19,113	11,079	1.72	NO 6	7,224
2421	GY 298	EM BK W/O M	RF25	7,227	243	24,704	11,079	2.22	NO 6	7,224
2422	GY 298	ENL PERS ME	RF25	10,363	291	29,546	15,886	1.85	NO 6	10,358
2423	GY 298	EM BK W/O M	RF25	7,227	243	24,704	11,079	2.22	NO 6	7,224
2425	GY 298	FE MNT SHOP	RF7	10,202	254	25,798	22,186	1.16	NO 6	10,426
2426	GY 298	DISP W/O BE	RF25	2,281	70	7,127	3,498	2.03	NO 6	2,281
2427	GY 298	POST RESTAU	RF25	2,395	67	6,844	3,679	1.85	NO 6	2,399
2433	GY 298	AR DEL EQP	RF9	28,589	713	72,311	62,185	1.16	NO 6	29,224
3188	GY 374	THEAT W/ ST	RF9	15,953	442	52,606	36,388	1.44	NO 2	17,100
3200	GY 380	EM BK W/O M	RF11	121,124	2,828	179,040	61,930	2.89	COAL	40,382
3203	GY 380	ADM GEN PUR	RF11	36,753	497	31,483	14,075	2.23	COAL	9,178
3205	GY 380	ADM & LIBRA	RF11	18,942	342	21,665	9,686	2.23	COAL	6,316
3206	GY 380	ENL PERS ME	RF29	22,264	1,492	94,482	56,733	1.66	COAL	22,251
3208	GY 380	FIN ADM BLD	RF3	45,059	248	15,743	15,549	1.01	COAL	11,265
3209	GY 380	EM BK W/O M	RF20	67,099	500	31,657	20,567	1.53	COAL	16,764
3210	GY 380	EM BK W/O M	RF20	73,728	500	31,657	20,567	1.53	COAL	16,764
3211	GY 380	ADM GEN PUR	RF3	44,285	244	15,458	15,267	1.01	COAL	11,061
3212	GY 380	GEN E DEV F	RF11	21,082	264	16,729	8,085	2.06	COAL	5,272
3213	GY 380	EM BK W/O M	RF20	55,971	417	26,415	17,161	1.53	COAL	13,988
3214	GY 380	ADM GEN PUR	RF11	19,403	262	16,646	7,442	2.23	COAL	4,852
3221	GY 380	EXCH SP SUP	RF25	2,099	53	3,398	3,283	1.03	COAL	2,141
3222	GY 380	MOTOR REP S	RF2	7,016	425	26,915	12,391	2.17	COAL	7,026
3224	GY 380	EM SVC CLUB	RF11	35,684	1,173	74,253	30,791	2.41	COAL	20,078
3225	GY 380	CLO SALES	RF15	12,206	518	32,800	18,712	1.75	COAL	12,201

Table 3-2. Savings Weatherization Roofs, Kaiserslautern (continued)

BLDG	KASERNE	FUNCTION	ROOF TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT ROOF
3226	GY 380	BN HQ BLDG	RF20	12,678	175	11,109	9,329	1.19	COAL	7,604
3227	GY 380	EM BK W/O M	RF20	33,985	253	16,031	10,415	1.53	COAL	8,489
3228	GY 380	CO HQ BLDG	RF11	2,765	74	4,739	2,118	2.23	COAL	1,381
3229	GY 380	ADM GEN PUR	RF11	21,452	290	18,380	8,217	2.23	COAL	5,358
3230	GY 380	COMM CENTER	RF11	8,830	221	26,270	6,765	3.88	NO 2	4,411
3233	GY 380	GEN INST BL	RF3	36,453	202	12,811	12,653	1.01	COAL	9,167
3234	GY 380	MOTOR REP S	RF2	5,881	356	22,546	10,380	2.17	COAL	5,885
3242	GY 380	EM BK W/O M	RF3	36,667	261	16,559	12,653	1.30	COAL	9,167
3243	GY 380	ENL PERS ME	RF4	20,385	246	15,612	14,699	1.06	COAL	6,907
3244	GY 380	EM BK W/O M	RF3	39,818	261	16,559	12,653	1.30	COAL	9,167
3245	GY 380	EM BK W/O M	RF3	36,667	261	16,559	12,653	1.30	COAL	9,167
3246	GY 380	EM BK W/O M	RF3	55,971	399	25,266	19,306	1.30	COAL	13,988
3251	GY 380	MOTOR REP S	RF5	9,835	1,133	71,780	25,101	2.85	COAL	9,845
3252	GY 380	MOTOR REP S	RF2	13,874	979	62,033	28,560	2.17	COAL	16,193
3254	GY 380	MOTOR REP S	RF2	14,419	876	55,480	25,542	2.17	COAL	14,482
3265	GY 380	OPEN MESS	RF11	19,585	380	45,257	9,999	4.52	NO 2	6,520
3266	GY 380	SIG ADM BLD	RF19	25,178	610	72,541	32,177	2.25	NO 2	20,982
3700	GY 382	HOSPITAL	RF11	54,476	696	44,116	16,699	2.64	COAL	10,889
3701	GY 382	GENEDEV/EXC	RF11	28,156	352	22,328	10,792	2.06	COAL	7,037
3702	GY 382	EM MD BK	RF11	58,085	813	51,474	17,805	2.89	COAL	11,610
3703	GY 382	LABORATORY	RF11	65,371	836	52,965	20,049	2.64	COAL	13,073
3704	GY 382	SENTRY STAT	RF11	4,262	106	12,686	3,267	3.88	NO 2	2,130
3705	GY 382	EM SERV BLD	RF11	27,562	345	21,850	10,560	2.06	COAL	6,886
3707	GY 382	EM MD BK	RF11	60,201	843	53,383	18,465	2.89	COAL	12,040
3716	GY 382	EW BK W/O M	RF11	58,085	813	51,474	17,805	2.89	COAL	11,610
3717	GY 382	STHS / AUTO	RF11	8,068	453	28,684	13,184	2.17	COAL	8,597
3722	GY 382	BOWLING CTR	RF11	26,568	897	56,838	24,620	2.30	COAL	16,053
3732	GY 382	VET FAC	RF11	9,513	304	19,268	7,293	2.64	COAL	4,755
3736	GY 382	FIRE STATIO	RF18	4,793	362	22,917	20,010	1.14	COAL	4,788
3737	GY 382	FE MNT SHOP	RF18	6,596	469	29,749	27,564	1.07	COAL	6,595
3738	GY 382	MEDICAL LAB	RF11	25,961	553	35,048	13,267	2.64	COAL	8,651
3741	GY 382	P O MAIN	RF25	3,556	95	6,052	5,445	1.11	COAL	3,550
3752	GY 382	BOQ MIL FEM	RF3	35,063	199	12,652	9,668	1.30	COAL	7,004
3754	GY 382	BOQ MIL FEM	RF3	35,063	199	12,652	9,668	1.30	COAL	7,004
3756	GY 382	BOQ MIL FEM	RF3	35,063	199	12,652	9,668	1.30	COAL	7,004
3757	GY 382	HOSPITAL	RF11	26,518	848	53,706	20,329	2.64	COAL	13,256
3758	GY 382	HOSPITAL	RF11	15,198	486	30,776	11,650	2.64	COAL	7,596
3759	GY 382	HOSPITAL	RF11	15,233	486	30,776	11,650	2.64	COAL	7,596
3760	GY 382	OPS GEN PUR	RF11	15,619	546	34,586	11,963	2.89	COAL	7,801
3761	GY 382	HOSPITAL	RF11	26,518	848	53,706	20,329	2.64	COAL	13,256
3762	GY 382	HOSPITAL	RF11	26,518	848	53,706	20,329	2.64	COAL	13,256
3763	GY 382	HOSPITAL	RF11	16,000	511	32,389	12,260	2.64	COAL	7,994
3764	GY 382	HOSP CLINIC	RF11	18,000	575	36,443	13,795	2.64	COAL	8,995
3765	GY 382	OPS GEN PUR	RF11	36,909	1,843	116,689	40,362	2.89	COAL	26,318
3766	GY 382	CLINIC / AD	RF11	35,102	1,597	101,131	45,214	2.23	COAL	29,482
3767	GY 382	HOSP CLINIC	RF11	32,693	1,046	66,217	25,065	2.64	COAL	16,344
3769	GY 382	HOSPITAL	RF11	14,420	461	29,207	11,056	2.64	COAL	7,209
3770	GY 382	HOSPITAL	RF11	15,199	486	30,776	11,650	2.64	COAL	7,596
3771	GY 382	MNT / CLINI	RF11	14,420	403	25,524	11,056	2.30	COAL	7,209
3772	GY 382	HOSPITAL	RF11	26,518	848	53,706	20,329	2.64	COAL	13,256
3776	GY 382	LIBRARY	RF11	4,719	263	16,685	7,227	2.30	COAL	4,712
3780	GY 382	OPN MESS OF	RF11	11,423	666	42,220	17,508	2.41	COAL	11,416

Table 3-2. Savings Weatherization Roofs, Kaiserslautern (continued)

BLDG	KASERNE	FUNCTION	ROOF TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT ROOF
3792	GY 382	MED ADM BLD	RF11	12,632	342	21,665	9,686	2.23	COAL	6,316
3794	GY 382	OPN MESS NC	RF11	9,571	360	42,867	9,471	4.52	NO 2	6,176
3800	GY 382	MOTOR REP S	RF2	5,770	350	22,216	10,228	2.17	COAL	5,799
3809	GY 382	LAB/ADM/EM	RF11	72,966	2,299	145,551	50,346	2.89	COAL	32,828
3812	GY 382	CHILD CARE	RF11	9,114	254	16,114	6,980	2.30	COAL	4,551
3813	GY 382	EM BK W/O M	RF3	13,324	126	8,026	6,133	1.30	COAL	4,443
3815	GY 382	EM BK W/O M	RF3	13,324	126	8,026	6,133	1.30	COAL	4,443
3820	GY 382	ADM / CLASS	RF11	13,646	246	15,612	6,980	2.23	COAL	4,551
3821	GY 382	SEBQ	RF3	13,035	124	7,852	5,999	1.30	COAL	4,347
3823	GY 382	SEBQ	RF3	13,035	124	7,852	5,999	1.30	COAL	4,347
3824	GY 382	EM BK W/O M	RF11	14,424	340	21,563	7,458	2.89	COAL	4,863
3007	GY 455	MOTOR REP S	RF2	11,559	703	44,516	20,494	2.17	COAL	11,620
3008	GY 455	MOTOR REP S	RF2	11,559	703	44,516	20,494	2.17	COAL	11,620
3010	GY 455	MOTOR REP S	RF2	7,008	430	27,245	12,543	2.17	COAL	7,112
3011	GY 455	MOTOR REP S	RF2	7,008	430	27,245	12,543	2.17	COAL	7,112
3012	GY 455	MOTOR REP S	RF2	7,008	430	27,245	12,543	2.17	COAL	7,112
3013	GY 455	MOTOR REP S	RF2	11,896	725	45,917	21,140	2.17	COAL	11,986
3014	GY 455	MRS & RESTR	RF29	26,516	1,781	112,758	67,706	1.66	COAL	26,555
3042	GY 455	MOTOR REP S	RF9	11,445	288	29,286	25,185	1.16	NO 6	11,836
3043	GY 455	MOTOR REP S	RF17	10,438	205	20,821	15,282	1.36	NO 6	11,072
3050	GY 455	MOTOR REP S	RF17	7,758	151	15,337	11,257	1.36	NO 6	8,156
3051	GY 455	MOTOR REP S	RF17	7,762	151	15,337	11,257	1.36	NO 6	8,156
3053	GY 455	ORD ADM BLD	RF11	5,146	278	28,261	7,887	3.58	NO 6	5,143
3057	GY 455	ELEC MNT SH	RF11	19,375	1,020	103,514	29,702	3.48	NO 6	19,368
3058	GY 455	PO BRANCH	RF20	17,988	428	43,433	22,059	1.96	NO 6	17,979
3083	GY 455	RECR BLDG	RF11	6,737	376	44,757	10,329	4.33	NO 2	6,735
3091	GY 455	GEN MNT SHO	RF5	2,166	250	29,740	5,541	5.36	NO 2	2,173
3401	GY 490	QM REPAIR S	RF2	35,467	2,145	217,561	62,528	3.47	NO 6	35,454
3403	GY 490	FIXED LAUND	RF29	40,631	2,639	267,652	104,797	2.55	NO 6	41,103
3406	GY 490	GEN PURP WH	RF4	61,637	407	41,282	27,223	1.51	NO 6	12,793
3408	GY 490	CALIBR & RE	RF29	17,819	1,087	129,188	45,814	2.81	NO 2	17,969
3413	GY 490	SUP SVC ADM	RF29	16,320	508	60,444	20,849	2.89	NO 2	8,177
3416	GY 490	GEN PURP WH	RF5	12,163	1,414	168,001	31,686	5.30	NO 2	12,427
3424	GY 490	QM REPAIR S	RF18	4,425	315	31,952	18,481	1.72	NO 6	4,422
110	GY 542	POST RESTAU	RF25	3,850	108	12,873	5,907	2.17	NO 2	3,852
162	GY 542	EM BK / BN	RF3	41,949	299	35,564	14,480	2.45	NO 2	10,491
163	GY 542	ENL PERS ME	RF11	9,296	543	64,525	14,257	4.52	NO 2	9,296
164	GY 542	ADM BLDG (A	RF3	41,949	231	27,515	14,480	1.90	NO 2	10,491
179	GY 542	GP HQ BLDG	RF3	21,256	156	18,569	9,772	1.90	NO 2	7,080
270	GY 542	OPS GEN PUR	RF1	5,380	264	31,444	13,716	2.29	NO 2	5,380
292	GY 542	CO HQ BLDG	RF29	3,943	122	7,755	5,020	1.54	COAL	1,969
310	GY 542	MOTOR REP S	RF5	4,323	498	59,186	11,028	5.36	NO 2	4,325
331	GY 542	GEN STOREHO	RF9	3,875	95	11,340	8,425	1.34	NO 2	3,959
332	GY 542	GEN STOREHO	RF9	3,875	95	11,340	8,425	1.34	NO 2	3,959
335	GY 542	GEN STOREHO	RF9	3,875	95	11,340	8,425	1.34	NO 2	3,959
336	GY 542	GEN STOREHO	RF9	3,875	95	11,340	8,425	1.34	NO 2	3,959
337	GY 542	ADM GEN PUR	RF20	3,875	89	10,621	4,752	2.23	NO 2	3,873
339	GY 542	GEN STOREHO	RF9	3,875	95	11,340	8,425	1.34	NO 2	3,959
344	GY 542	GEN STOREHO	RF9	3,875	95	11,340	8,425	1.34	NO 2	3,959
346	GY 542	GEN STOREHO	RF9	3,875	95	11,340	8,425	1.34	NO 2	3,959
369	GY 542	MOTOR REP S	RF5	3,400	391	46,524	8,669	5.36	NO 2	3,400
370	GY 542	MOTOR REP S	RF5	3,400	391	46,524	8,669	5.36	NO 2	3,400

Table 3-2. Savings Weatherization Roofs, Kaiserslautern (continued)

BLDG	KASERNE	FUNCTION	ROOF TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT ROOF
371	GY 542	MOTOR REP S	RF5	3,400	391	46,524	8,669	5.36	NO 2	3,400
372	GY 542	MTL & WDWK	RF17	3,400	63	7,491	4,693	1.59	NO 2	3,400
394	GY 542	MOTOR REP S	RF5	10,543	1,240	147,377	27,461	5.36	NO 2	10,770
395	GY 542	MOTOR REP S	RF5	10,543	1,240	147,377	27,461	5.36	NO 2	10,770
637	GY 542	WTNG SHELTE	RF7	5,046	119	14,209	10,967	1.29	NO 2	5,154
646	GY 542	MOTOR REP S	RF5	4,332	536	33,968	11,878	2.85	COAL	4,659
3000	GY 565	WAREHOUSE	RF5	11,340	1,469	93,003	32,920	2.82	COAL	12,912
3006	GY 565	MOTOR REPAI	RF2	4,965	300	19,001	8,748	2.17	COAL	4,960
3009	GY 565	MOTOR REPAI	RF2	3,872	234	14,838	6,831	2.17	COAL	3,873
3029	GY 565	QM REPAIR S	RF17	30,041	556	66,164	41,450	1.59	NO 2	30,031
3100	GY 680	EM BK W/O M	RF11	57,645	681	80,938	14,917	5.42	NO 2	9,727
3101	GY 680	ADM & SUP /	RF11	55,014	731	86,955	16,026	5.42	NO 2	10,450
3102	GY 680	EM BK W/O M	RF11	55,014	731	86,955	16,026	5.42	NO 2	10,450
3103	GY 680	EM BK W/O M	RF11	55,014	731	86,955	16,026	5.42	NO 2	10,450
3104	GY 680	ADM GEN PUR	RF11	60,278	642	76,349	18,187	4.19	NO 2	11,859
3106	GY 680	ENL PERS ME	RF11	27,550	402	47,796	10,560	4.52	NO 2	6,886
3107	GY 680	ADM GEN PUR	RF11	27,550	373	44,333	10,560	4.19	NO 2	6,886
3113	GY 680	FE FAC	RF14	5,061	107	12,795	7,054	1.81	NO 2	5,111
3114	GY 680	MOTOR REP S	RF18	10,659	776	78,753	45,551	1.72	NO 6	10,899
3115	GY 680	SKILL DEV G	RF25	3,170	86	8,749	5,214	1.67	NO 6	3,400
3116	GY 680	MOTOR REP S	RF18	10,842	789	80,074	46,315	1.72	NO 6	11,082
3117	GY 680	MOTOR REP S	RF18	13,695	979	99,277	57,422	1.72	NO 6	13,740
2850	GY 744	GEN PURP WH	RF5	2,135	243	28,945	5,459	5.30	NO 2	2,141
2855	GY 744	MOTOR REP S	RF5	2,618	306	36,395	6,781	5.36	NO 2	2,659
2861	GY 744	EM BK W/O M	RF1	15,870	560	35,510	20,805	1.70	COAL	8,160
2862	GY 744	CO HQ BLDG	RF29	3,943	123	7,848	5,080	1.54	COAL	1,992
2863	GY 744	EM BK W/O M	RF1	15,870	560	35,510	20,805	1.70	COAL	8,160
2864	GY 744	POST RESTAU	RF29	3,943	133	8,461	5,080	1.66	COAL	1,992
2865	GY 744	EM BK W/O M	RF1	15,870	560	35,510	20,805	1.70	COAL	8,160
2866	GY 744	CO HQ BLDG	RF29	3,943	123	7,848	5,080	1.54	COAL	1,992
2867	GY 744	EM BK W/O M	RF29	10,585	437	27,715	13,881	1.99	COAL	5,444
2869	GY 744	MORGUE	RF29	6,926	366	43,585	12,729	3.42	NO 2	4,992
2872	GY 744	GEN PURP WH	RF18	3,622	254	25,845	15,131	1.70	NO 6	3,620
2874	GY 744	EM BK W/O M	RF18	18,489	873	88,618	38,572	2.29	NO 6	9,229
2879	GY 744	EM BK W/O M	RF20	18,468	275	27,920	11,324	2.46	NO 6	9,229
2885	GY 744	UNIT CHAPEL	RF25	2,580	71	4,530	4,075	1.11	COAL	2,657
2886	GY 744	EM BK W/O M	RF20	18,468	275	27,920	11,324	2.46	NO 6	9,229
2890	GY 744	EM BK W/O M	RF20	18,468	275	27,920	11,324	2.46	NO 6	9,229
2895	GY 744	ENL PER MES	RF18	18,400	1,453	147,354	76,893	1.91	NO 6	18,399
2897	GY 744	ADM GEN PUR	RF25	6,723	175	20,845	10,313	2.02	NO 2	6,725
2902	GY 744	MOTOR REP S	RF4	4,929	160	16,236	10,577	1.53	NO 6	4,971
2909	GY 744	GEN STOREHO	RF4	2,180	71	7,242	4,776	1.51	NO 6	2,244
2910	GY 744	GEN STOREHO	RF4	2,180	71	7,242	4,776	1.51	NO 6	2,244
2911	GY 744	GEN STOREHO	RF4	2,180	71	7,242	4,776	1.51	NO 6	2,244
2912	GY 744	GEN STOREHO	RF4	2,180	71	7,242	4,776	1.51	NO 6	2,244
2917	GY 744	DISP W/ BED	RF18	6,588	284	28,886	13,759	2.09	NO 6	3,292
2918	GY 744	BOQ MIL MAL	RF18	6,588	311	31,612	13,759	2.29	NO 6	3,292
2919	GY 744	BOQ MIL MAL	RF18	6,588	311	31,612	13,759	2.29	NO 6	3,292
2921	GY 744	BOQ MIL MAL	RF18	6,588	311	31,612	13,759	2.29	NO 6	3,292
2922	GY 744	BOQ MIL MAL	RF18	6,588	311	31,612	13,759	2.29	NO 6	3,292
2925	GY 744	EM BK W/O M	RF20	18,468	275	27,927	11,326	2.46	NO 6	9,232
2928	GY 744	EM BK W/O M	RF20	18,468	275	27,927	11,326	2.46	NO 6	9,232

Table 3-2. Savings Weatherization Roofs, Kaiserslautern (continued)

BLDG	KASERNE	FUNCTION	ROOF TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT ROOF
2930	GY 744	EM BK W/O M	RF20	18,468	275	27,927	11,326	2.46	NO 6	9,232
2933	GY 744	ADM GEN PUR	RF20	12,326	142	14,429	7,564	1.90	NO 6	6,165
2935	GY 744	XMTR BLDG/A	RF20	12,326	142	14,429	7,564	1.90	NO 6	6,165

TOTAL ANNUAL HEAT SAVINGS MBTU	113,387
TOTAL DOLLAR SAVINGS	9,968,603
TOTAL COST	4,392,440
TOTAL SQFT	4,119,741
TOTAL SQFT ROOFS	2,306,823
PEAK LOAD REDUCTION	39,503,088

3.1.1.2. Heating System Modifications

Indoor space temperatures are controlled manually by occupants. Whenever the outdoor temperature is warm enough so that the capacity of the radiators at the manual valve setting is greater than the space heat loss, the space temperature rises above that required. Further, there is no means to set back the temperature when the building is not occupied. A peak heating load was calculated for each building. With the peak heat load and degree-days from TM 5-785, the Modified Degree-Day Method can be used to estimate annual fuel consumption.

At Kaiserslautern, 31 buildings were subjected to a computerized hourly energy analysis. Several computer simulations were made on each one of the representative administration, housing, maintenance, operations and warehouse buildings to determine energy consumption at different operating temperatures and operating conditions such as night setback. In all, 67 simulations were performed. The two most common deficiencies in the existing heating systems are the lack of control of the terminal heating devices and lack of means of reducing space temperatures during unoccupied periods. The savings in percent of total consumption resulting from the addition of these features was determined from the computer simulations. Because barracks are occupied on weekends, the amount of savings is less than for

Administrative buildings. Shops and warehouses can be set back at all times. Average space temperatures were estimated based on a judgment of the percent of people occupancy of these facilities based on the field survey. The construction costs are based on the assumption that the existing recirculation pumps are to be replaced by new pumps since experience has shown that these pumps normally have too low of a pressure head to be reused in systems containing thermostatic radiator valves and zone control valves. The construction costs are based on the assumption that the average number of heating units per building is ten (10) each. There were ten (10) heaters average in the buildings surveyed so this average will be used for all motor repair shops and warehouses. The costs for central components are shared by this quantity and added to the unit costs.

Heating losses and annual consumption are based on the assumption that existing wall and roof materials will remain unchanged. It is always more economical to install temperature control and night setback than building insulation.

Results.

The buildings where installation of thermostatic valves have SIRs greater than one (1) are listed in Table 3-3. Buildings where installation of night setback controllers results in an SIR of one or more are listed in Table 3-4. Shops and warehouses where installation of night and weekend setback controllers result in a SIR of one (1) or greater are listed in Table 3-5.

SAVINGS	HEAT (MBTU)	FUEL (MBTU)
(1) Coal		
Thermostats (Table E-2)	14,884	21,263
Night Setback (Table E-3)	22,935	32,764
24-Hour Setback (Table E-4)	20,646	29,494
Subtotal	58,465	83,521
(2) Heavy Oil		
Thermostats	1,772	2,215
Night Setback	3,254	4,068
24-Hour Setback	48,004	60,005
Subtotal	53,030	66,288
(3) Light Oil		
Thermostats	5,171	7,387
Night Setback	9,212	13,160
24-Hour Setback	10,421	14,887
Subtotal	24,804	35,434
TOTAL	136,299	185,243

Costs -	
Thermostats	$ 155,350
Night Setback	$ 431,550
24-Hour Setback	$ 262,800
TOTAL	$ 849,700

SIR = 14.9

Table 3-3. Thermostat Savings, Kaiserslautern

BLDG	FUNCTION	PRESENT CONSUMPTION MBTU/YEAR	REVISED CONSUMPTION MBTU/YEAR	ANNUAL SAVINGS MBTU	ANNUAL SAVINGS $	COST $	SIR	NUMBER OF VALVES
2615	EM BK W/MESS	650	552	97	1,019	747	8.98	30
2618	OPS GEN PURP	470	399	70	737	149	32.65	6
2619	READY BLDG	304	258	45	477	398	7.87	16
2202	ADM GEN PURP	264	224	39	302	573	4.19	23
2270	POST RESTAURNT	186	158	27	213	348	4.86	14
2276	ADM GEN PURP	688	585	103	787	697	9.05	28
2279	ADM GEN PURP	489	416	73	560	473	9.49	19
2292	EAM BLDG	994	845	149	1,137	872	10.47	35
2293	ADM GEN PURP	1,111	944	166	1,272	1,993	5.08	80
2374	ADM GEN PURP	808	687	121	925	872	8.50	35
2384	ADM GEN PURP	456	388	68	716	1,121	4.17	45
2408	EM BK W/O MS	716	609	107	820	1,046	6.26	42
2409	ADM GEN PURP	240	204	36	275	348	6.31	14
2410	GEN INST BLDG	269	229	40	308	423	5.82	17
2411	EM BK W/O MS	716	609	107	820	1,071	6.11	43
2412	EM BK W/O MS	716	609	107	820	1,071	6.11	43
2414	SUP SVC ADM	221	188	33	253	423	4.76	17
2418	ADM GEN PURP	228	194	34	261	623	3.32	25
2419	SUP SVC ADM	260	221	39	298	573	4.14	23
2420	ADM & EM BK	676	575	101	774	872	7.10	35
2421	EM BK W/O MS	716	609	107	820	1,071	6.11	43
2422	ENL PERS MESS	723	614	108	827	647	10.25	26
2423	EM BK W/O MS	716	609	107	820	1,071	6.11	43
2427	POST RESTAURNT	210	178	31	240	174	11.08	7
3200	EM BK W/O MS	9,035	7,680	1,355	5,574	5,482	9.38	220
3206	ENL PERS MESS	3,314	2,816	497	2,044	623	30.41	25
3209	EM BK W/O MS	3,089	2,626	463	1,906	1,993	8.81	80
3210	EM BK W/O MS	3,089	2,626	463	1,906	1,993	8.81	80
3211	ADM GEN PURP	1,708	1,451	256	1,053	1,993	4.84	80
3212	GEN E DEV FAC	1,065	905	159	657	1,993	2.99	80
3213	EM BK W/O MS	2,229	1,894	334	1,375	1,844	6.86	74
3214	ADM GEN PURP	964	820	144	595	49	10.85	2
3225	CLO SALES	1,550	1,317	232	956	946	9.31	38
3226	BN HQ BLDG	659	560	98	406	448	8.36	18
3227	EM BK W/O MS	1,994	1,695	299	1,230	2,242	5.03	90
3228	CO HQ BLDG	321	273	48	198	448	4.04	18
3229	ADM GEN PURP	966	821	144	596	49	11.02	2
3230	COMM CENTER	611	519	91	959	299	21.22	12
3231	BOWLING CTR	1,080	918	162	666	348	17.67	14
3235	GYMNASIUM	2,022	1,718	303	1,247	199	58.05	8
3265	OPEN MESS	1,279	1,087	191	2,006	996	13.29	40
3266	SIG ADM BLDG	1,604	1,363	240	2,516	647	25.71	26
3702	EM MD BK	2,884	2,451	432	1,779	4,386	3.70	176
3707	EM MD BK	2,359	2,005	353	1,455	4,386	3.02	176
3716	EW BK W/O MS	2,884	2,451	432	1,779	4,386	3.70	176
3722	BOWLING CTR	1,702	1,447	255	1,050	348	27.90	14
3732	VET FAC	626	532	93	386	623	5.69	25
3741	P O MAIN	463	394	69	286	274	9.63	11

Table 3-3. Thermostat Savings, Kaiserslautern (continued)

BLDG	FUNCTION	PRESENT CONSUMPTION MBTU/YEAR	REVISED CONSUMPTION MBTU/YEAR	ANNUAL SAVINGS MBTU	ANNUAL SAVINGS $	COST $	SIR	NUMBER OF VALVES
3751	BOQ MIL MALE	635	540	95	392	1,594	2.22	64
3758	HOSPITAL	1,516	1,288	227	935	2,292	3.72	92
3759	HOSPITAL	1,361	1,157	204	840	5,482	1.36	220
3760	OPS GEN PURP	1,945	1,653	291	1,200	2,242	4.90	90
3761	HOSPITAL	2,280	1,938	342	1,407	5,183	2.45	208
3762	HOSPITAL	2,280	1,938	342	1,407	5,183	2.45	208
3763	HOSPITAL	1,301	1,106	195	803	2,741	2.65	110
3764	HOSP CLINIC	1,623	1,379	243	1,001	1,370	6.72	55
3765	OPS GEN PURP	4,027	3,423	604	2,484	9,270	2.42	372
3766	CLINIC / ADM	4,367	3,712	655	2,694	3,239	7.66	130
3769	HOSPITAL	1,290	1,097	193	796	1,495	4.88	60
3770	HOSPITAL	1,516	1,288	227	935	1,370	6.27	55
3771	MNT / CLINIC	1,696	1,441	254	1,046	1,495	6.43	60
3772	HOSPITAL	2,583	2,195	387	1,593	1,495	9.83	60
3775	ENL PERS MESS	2,484	2,112	372	1,532	922	15.37	37
3776	LIBRARY	819	696	122	505	946	4.89	38
3780	OPN MESS OFF	1,735	1,475	260	1,070	697	14.19	28
3792	MED ADM BLDG	1,043	886	156	643	1,869	3.13	75
3794	OPN MESS NCO	928	789	139	1,456	1,221	7.85	49
3809	LAB/ADM/EM BK	5,256	4,467	788	3,242	1,246	24.10	50
3810	SCHOOL/ADM/LAB	2,953	2,510	443	1,822	3,140	5.32	126
3812	CHILD CARE CTR	778	661	116	480	1,071	4.10	43
3813	EM BK W/O MS	766	651	114	472	1,345	3.19	54
3815	EM BK W/O MS	766	651	114	472	1,345	3.19	54
3818	BN HQ BLDG	450	382	67	277	697	3.63	28
3819	BLDGS MNT STHS	503	427	75	310	697	4.06	28
3820	ADM / CLASSRMS	756	643	113	466	1,345	3.15	54
3821	SEBQ	508	431	76	313	1,171	2.42	47
3823	SEBQ	508	431	76	313	1,171	2.42	47
3824	EM BK W/O MS	900	765	135	555	1,345	3.77	54
3053	ORD ADM BLDG	859	730	128	983	373	21.17	15
3083	RECR BLDG	1,235	1,050	185	1,937	249	51.53	10
3413	SUP SVC ADM	1,512	1,285	226	2,372	1,420	11.02	57
110	POST RESTAURNT	314	267	47	494	672	4.81	27
162	EM BK / BN HQ	2,385	2,027	357	3,741	1,545	16.00	62
163	ENL PERS MESS	1,255	1,066	188	1,968	523	24.90	21
164	ADM BLDG (A F)	2,050	1,742	307	3,216	1,545	13.75	62
179	GP HQ BLDG	1,146	974	172	1,798	448	26.55	18
273	EM BK W/O MS	419	356	62	259	623	3.80	25
274	EM BK W/O MS	365	310	54	225	623	3.30	25
275	EMM BK W/O MS	419	356	62	259	623	3.80	25
276	CO HQ BLDG	353	300	53	218	423	4.72	17
277	CO HQ BLDG	353	300	53	218	423	4.72	17
278	EM BK W/O MS	419	356	62	259	623	3.80	25
279	EM BK W/O MS	365	310	54	225	623	3.30	25
280	E BK W/O MS	419	356	62	259	623	3.80	25
281	CO HQ BLDG	353	300	53	218	423	4.72	17

Table 3-3. Thermostat Savings, Kaiserslautern (continued)

BLDG	FUNCTION	PRESENT CONSUMPTION MBTU/YEAR	REVISED CONSUMPTION MBTU/YEAR	ANNUAL SAVINGS MBTU	ANNUAL SAVINGS $	COST $	SIR	NUMBER OF VALVES
282	EM BK W/O MS	419	356	62	259	623	3.80	25
283	EM BK W/O MS	365	310	54	225	623	3.30	25
284	EM BK W/O MS	419	356	62	259	623	3.80	25
285	GEN INST BLDG	308	262	46	190	274	6.38	11
286	ADM GEN PURP	333	283	50	205	373	5.04	15
289	EM BK W/O MS	526	447	78	324	573	5.19	23
292	CO HQ BLDG	450	382	67	277	448	5.69	18
630	AMMO RENV SHOP	1,118	950	167	1,754	996	11.61	40
637	WTNG SHELTER	670	569	100	1,051	448	15.49	18
695	CHEMISTRY LAB	1,520	1,292	228	2,385	199	79.35	8
705	ADM GEN PURP	158	135	23	249	174	9.42	7
3100	EM BK W/O MS	2,313	1,966	347	3,628	1,869	12.82	75
3101	ADM & SUP / BK	2,448	2,081	367	3,840	1,869	13.57	75
3102	EM BK W/O MS	2,448	2,081	367	3,840	1,869	13.57	75
3103	EM BK W/O MS	2,448	2,081	367	3,840	1,869	13.57	75
3104	ADM GEN PURP	2,090	1,777	313	3,279	1,869	11.58	75
3106	ENL PERS MESS	1,291	1,097	193	2,025	1,869	7.13	75
3113	FE FAC	373	317	56	585	299	12.94	12
3150	POST CHAPEL	1,390	1,181	208	2,180	872	16.52	35
TOTALS				21,789	128,667	148,902		5,975

Table 3-4. Set Back Savings, Kaiserslautern

BLDG	FUNCTION	BASELINE CONSUMPTION MBTU/YEAR	REVISED CONSUMPTION MBTU/YEAR	ANNUAL SAVINGS MBTU	ANNUAL SAVINGS $	COST $	SIR	NUMBER OF RESET CONTROLLERS
2615	EM BK W/MESS	552	408	143	1,502	3,019	5.65	1
2618	OPS GEN PURP	399	255	143	1,504	3,019	5.65	1
2619	READY BLDG	258	165	93	973	3,019	3.66	1
2202	ADM GEN PURP	224	143	80	616	3,019	2.71	1
2270	POST RESTAURNT	158	110	47	362	3,019	1.59	1
2276	ADM GEN PURP	585	374	210	1,606	3,019	7.07	1
2279	ADM GEN PURP	416	266	149	1,143	3,019	5.03	1
2292	EAM BLDG	845	540	304	2,321	3,019	10.21	1
2293	ADM GEN PURP	944	604	340	2,595	3,019	11.42	1
2374	ADM GEN PURP	687	440	247	1,888	3,019	8.31	1
2384	ADM GEN PURP	388	248	139	1,461	3,019	5.49	1
2408	EM BK W/O MS	609	450	158	1,208	3,019	5.31	1
2409	ADM GEN PURP	204	130	73	561	3,019	2.47	1
2410	GEN INST BLDG	229	146	82	629	3,019	2.77	1
2411	EM BK W/O MS	609	450	158	1,208	3,019	5.31	1
2412	EM BK W/O MS	609	450	158	1,208	3,019	5.31	1
2414	SUP SVC ADM	188	120	67	516	3,019	2.27	1
2418	ADM GEN PURP	194	124	69	533	3,019	2.34	1

Table 3-4. Set Back Savings, Kaiserslautern (continued)

BLDG	FUNCTION	BASELINE CONSUMPTION MBTU/YEAR	REVISED CONSUMPTION MBTU/YEAR	ANNUAL SAVINGS MBTU	ANNUAL SAVINGS $	COST $	SIR	NUMBER OF RESET CONTROLLERS
2419	SUP SVC ADM	221	141	79	608	3,019	2.67	1
2420	ADM & EM BK	575	368	207	1,580	3,019	6.95	1
2421	EM BK W/O MS	609	450	158	1,208	3,019	5.31	1
2422	ENL PERS MESS	614	430	184	1,407	3,019	6.19	1
2423	EM BK W/O MS	609	450	158	1,208	3,019	5.31	1
2427	POST RESTAURNT	178	125	53	409	3,019	1.80	1
3200	EM BK W/O MS	7,680	5,683	1,996	8,213	12,077	10.46	4
3206	ENL PERS MESS	2,816	1,971	845	3,475	3,019	17.71	1
3209	EM BK W/O MS	2,626	1,943	682	2,808	6,038	7.15	2
3210	EM BK W/O MS	2,626	1,943	682	2,808	9,057	4.77	3
3211	ADM GEN PURP	1,451	929	522	2,149	6,038	5.47	2
3212	GEN E DEV FAC	905	579	325	1,340	3,019	6.83	1
3213	EM BK W/O MS	1,894	1,402	492	2,026	6,038	5.16	2
3214	ADM GEN PURP	820	524	295	1,214	3,019	6.18	1
3225	CLO SALES	1,317	843	474	1,950	3,019	9.94	1
3226	BN HQ BLDG	560	358	201	829	3,019	4.23	1
3227	EM BK W/O MS	1,695	1,254	440	1,813	3,019	9.24	1
3228	CO HQ BLDG	273	174	98	404	3,019	2.06	1
3229	ADM GEN PURP	821	525	295	1,216	3,019	6.19	1
3230	COMM CENTER	519	332	187	1,956	3,019	7.36	1
3231	BOWLING CTR	918	587	330	1,359	3,019	6.93	1
3235	GYMNASIUM	1,718	1,099	618	2,544	3,019	12.97	1
3265	OPEN MESS	1,087	761	326	3,411	3,019	12.83	1
3266	SIG ADM BLDG	1,363	872	490	5,134	3,019	19.31	1
3702	EM MD BK	2,451	1,814	637	2,621	6,038	6.68	2
3707	EM MD BK	2,005	1,484	521	2,144	6,038	5.46	2
3716	EW BK W/O MS	2,451	1,814	637	2,621	6,038	6.68	2
3722	BOWLING CTR	1,447	926	521	2,143	3,019	10.92	1
3732	VET FAC	532	452	79	328	3,019	1.67	1
3741	P O MAIN	394	252	141	583	3,019	2.97	1
3751	BOQ MIL MALE	540	399	140	577	3,019	2.94	1
3758	HOSPITAL	1,288	1,095	193	795	3,019	4.05	1
3759	HOSPITAL	1,157	983	173	714	3,019	3.64	1
3760	OPS GEN PURP	1,653	1,223	429	1,768	3,019	9.01	1
3761	HOSPITAL	1,938	1,647	290	1,196	3,019	6.09	1
3762	HOSPITAL	1,938	1,647	290	1,196	3,019	6.09	1
3763	HOSPITAL	1,106	940	166	682	3,019	3.48	1
3764	HOSP CLINIC	1,379	1,172	206	851	3,019	4.33	1
3765	OPS GEN PURP	3,423	2,533	890	3,661	6,038	9.33	2
3766	CLINIC / ADM	3,712	2,375	1,336	5,496	6,038	14.00	2
3769	HOSPITAL	1,097	932	164	676	3,019	3.44	1
3770	HOSPITAL	1,288	1,095	193	795	3,019	4.05	1
3771	MNT / CLINIC	1,441	922	519	2,134	3,019	10.88	1
3772	HOSPITAL	2,195	1,866	329	1,354	3,019	6.90	1
3775	ENL PERS MESS	2,112	1,478	633	2,606	3,019	13.28	1
3776	LIBRARY	696	445	250	1,031	3,019	5.25	1
3780	OPN MESS OFF	1,475	1,032	442	1,820	3,019	9.28	1
3792	MED ADM BLDG	886	567	319	1,313	3,019	6.69	1

Table 3-4. Set Back Savings, Kaiserslautern (continued)

BLDG	FUNCTION	BASELINE CONSUMPTION MBTU/YEAR	REVISED CONSUMPTION MBTU/YEAR	ANNUAL SAVINGS MBTU	ANNUAL SAVINGS $	COST $	SIR	NUMBER OF RESET CONTROLLERS
3794	OPN MESS NCO	789	552	236	2,475	3,019	9.31	1
3809	LAB/ADM/EM BK	4,467	3,306	1,161	4,777	9,057	8.11	3
3810	SCHOOL/ADM/LAB	2,510	1,606	903	3,717	6,038	9.47	2
3812	CHILD CARE CTR	661	423	238	980	3,019	4.99	1
3813	EM BK W/O MS	651	481	169	696	3,019	3.54	1
3815	EM BK W/O MS	651	481	169	696	3,019	3.54	1
3818	BN HQ BLDG	382	244	137	566	3,019	2.88	1
3819	BLDGS MNT STHS	427	316	111	457	3,019	2.33	1
3820	ADM / CLASSRMS	643	411	231	952	3,019	4.85	1
3821	SEBQ	431	319	112	461	3,019	2.35	1
3823	SEBQ	431	319	112	461	3,019	2.35	1
3824	EM BK W/O MS	765	566	198	818	3,019	4.17	1
3053	ORD ADM BLDG	730	467	262	2,006	3,019	8.83	1
3083	RECR BLDG	1,050	672	378	3,953	3,019	14.87	1
3413	SUP SVC ADM	1,285	822	462	4,840	3,019	18.21	1
110	POST RESTAURNT	267	187	80	839	3,019	3.15	1
162	EM BK / BN HQ	2,027	1,500	527	5,513	6,038	10.37	2
163	ENL PERS MESS	1,066	746	320	3,346	3,019	12.59	1
164	ADM BLDG (A F)	1,742	1,115	627	6,561	6,038	12.34	2
179	GP HQ BLDG	974	623	350	3,669	3,019	13.80	1
273	EM BK W/O MS	356	264	92	381	3,019	1.94	1
274	EM BK W/O MS	310	230	80	332	3,019	1.69	1
275	EMM BK W/O MS	356	264	92	381	3,019	1.94	1
276	CO HQ BLDG	300	192	108	445	3,019	2.26	1
277	CO HQ BLDG	300	192	108	445	3,019	2.26	1
278	EM BK W/O MS	356	264	92	381	3,019	1.94	1
279	EM BK W/O MS	310	230	80	332	3,019	1.69	1
280	E BK W/O MS	356	264	92	381	3,019	1.94	1
281	CO HQ BLDG	300	192	108	445	3,019	2.26	1
282	EM BK W/O MS	356	264	92	381	3,019	1.94	1
283	EM BK W/O MS	310	230	80	332	3,019	1.69	1
284	EM BK W/O MS	356	264	92	381	3,019	1.94	1
285	GEN INST BLDG	262	167	94	388	3,019	1.97	1
286	ADM GEN PURP	283	181	102	419	3,019	2.13	1
289	EM BK W/O MS	447	331	116	478	3,019	2.43	1
292	CO HQ BLDG	382	245	137	567	3,019	2.89	1
630	AMMO RENV SHOP	950	608	342	3,578	3,019	13.46	1
637	WTNG SHELTER	569	364	205	2,145	3,019	8.07	1
695	CHEMISTRY LAB	1,292	827	465	4,866	3,019	18.31	1
705	ADM GEN PURP	135	86	48	508	3,019	1.91	1
3100	EM BK W/O MS	1,966	1,455	511	5,346	6,038	10.05	2
3101	ADM & SUP / BK	2,081	1,540	541	5,658	6,038	10.64	2
3102	EM BK W/O MS	2,081	1,540	541	5,658	6,038	10.64	2
3103	EM BK W/O MS	2,081	1,540	541	5,658	6,038	10.64	2

Table 3-4. Set Back Savings, Kaiserslautern (continued)

BLDG	FUNCTION	BASELINE CONSUMPTION MBTU/YEAR	REVISED CONSUMPTION MBTU/YEAR	ANNUAL SAVINGS MBTU	ANNUAL SAVINGS $	COST $	SIR	NUMBER OF RESET CONTROLLERS
3104	ADM GEN PURP	1,777	1,137	639	6,690	6,038	12.58	2
3106	ENL PERS MESS	1,097	768	329	3,444	3,019	12.95	1
3113	FE FAC	317	203	114	1,195	3,019	4.49	1
3150	POST CHAPEL	1,181	756	425	4,448	3,019	16.73	1
TOTALS				35,402	215,511	413,640		137

Table 3-5. Reset Control Savings Shop and Warehouse, Kaiserslautern

BLDG	FUNCTION	BASELINE CONSUMPTION MBTU/YEAR	REVISED CONSUMPTION MBTU/YEAR	ANNUAL SAVINGS MBTU	ANNUAL SAVINGS $	COST $	SIR	NUMBER OF RESET CONTROLLERS
2213	INFL MAT STHS	3,153	1,892	1,261	9,625	2,760	34.01	8
2219	GEN PURP WHSE	3,013	1,807	1,205	9,195	2,760	31.94	8
2225	CML FLD MT SH	2,029	1,217	811	6,193	2,415	21.75	7
2226	CARE & PRES SH	1,963	1,178	785	5,992	3,450	10.75	10
2227	GEN PURP WHSE	470	282	188	1,434	690	15.30	2
2233A	ENG FLD MNT SH	16,115	9,669	6,446	49,183	18,978	22.11	55
2238	GEN PURP WHSE	1,791	1,074	716	5,466	2,760	13.99	8
2239	GEN PURP WHSE	2,786	1,671	1,114	11,656	3,105	30.31	9
2256	MIL BRIDGE FAC	3,166	1,900	1,266	9,664	1,380	80.73	4
2257	GEN PURP WHSE	987	592	394	3,012	2,070	7.01	6
2258	GEN PURP WHSE	2,664	1,598	1,065	8,132	4,830	10.04	14
2264	GEN PURP WHSE	3,994	2,396	1,597	12,189	5,175	18.97	15
2267	BOX & CRATE SH	1,977	1,186	791	6,035	3,105	13.50	9
2277	MNT SH WHSE	945	567	378	2,886	2,070	6.20	6
2280	GEN PURP WHSE	646	387	258	1,973	1,725	2.87	5
2281	GEN PURP WHSE	8,782	5,269	3,512	26,802	17,253	8.32	50
2288	CARE &PRES SH	2,101	1,261	840	6,414	4,140	8.26	12
2289	GEN PURP WHSE	9,239	5,543	3,695	28,197	10,006	25.12	29
2363	CARE & PRES SH	942	565	377	1,551	2,070	.79	6
2370	GEN PURP WHSE	2,381	1,429	952	9,963	2,760	28.67	8
2371A	GEN PURP WHSE	1,900	1,140	760	5,798	1,035	62.12	3
2371B	GEN PURP WHSE	1,900	1,140	760	5,798	1,035	62.12	3
2372A	GEN PURP WHSE	2,635	1,581	1,054	8,042	1,725	49.62	5
2372B	GEN PURP WHSE	2,635	1,581	1,054	8,042	1,380	65.11	4
2385	GEN PURP WHSE	2,237	1,342	894	9,358	2,760	26.18	8
2388	GEN PURP WHSE	1,094	656	437	4,576	1,380	25.34	4
2389	GEN PURP WHSE	1,228	737	491	3,749	1,380	23.77	4
2393	MOTOR REP SHOP	2,475	1,485	990	7,553	2,760	24.04	8
2394	MOTOR REP SHOP	1,314	788	525	4,010	2,760	6.98	8
2425	FE MNT SHOP	1,096	657	438	3,346	2,070	9.15	6
2433	AR DEL EQP MS	3,314	1,988	1,325	10,116	6,211	9.32	18
3222	MOTOR REP SHOP	1,477	886	591	2,431	1,725	9.36	5

Table 3-5. Reset Control Savings Shop and Warehouse, Kaiserslautern (continued)

BLDG	FUNCTION	BASELINE CONSUMPTION MBTU/YEAR	REVISED CONSUMPTION MBTU/YEAR	ANNUAL SAVINGS MBTU	ANNUAL SAVINGS $	COST $	SIR	NUMBER OF RESET CONTROLLERS
3234	MOTOR REP SHOP	1,303	781	521	2,143	1,380	11.57	4
3247	MOTOR REP SHOP	964	578	385	1,586	2,070	.52	6
3251	MOTOR REP SHOP	3,640	2,184	1,456	5,989	4,140	9.93	12
3252	MOTOR REP SHOP	2,611	1,567	1,044	4,297	3,105	8.97	9
3254	MOTOR REP SHOP	2,675	1,605	1,070	4,402	3,105	9.49	9
3255	MOTOR REP SHOP	984	590	393	1,620	2,070	.27	6
3257	MOTOR REP SHOP	1,831	1,098	732	3,012	2,070	10.07	6
3278	MOTOR REP SHOP	1,823	1,094	729	7,629	3,450	12.79	10
3717	STHS / AUTO SH	1,685	1,011	674	2,773	2,070	8.29	6
3719	GEN STOREHOUSE	939	563	375	1,546	2,070	.82	6
3723	MOTOR REP SHOP	1,222	733	489	2,011	1,380	10.10	4
3724	MOTOR REP SHOP	723	433	289	1,189	1,035	5.36	3
3736	FIRE STATION	791	506	284	1,171	1,035	5.09	3
3737	FE MNT SHOP	1,039	623	415	1,710	1,380	6.75	4
3740	GEN PURP WHSE	2,369	1,421	947	3,898	2,760	9.41	8
3800	MOTOR REP SHOP	1,195	717	478	1,967	1,380	9.61	4
3817	EXCH WHSE	288	173	115	475	345	8.87	1
3007	MOTOR REP SHOP	2,465	1,479	986	4,055	2,760	10.28	8
3008	MOTOR REP SHOP	2,611	1,567	1,044	4,297	2,760	11.63	8
3010	MOTOR REP SHOP	1,930	1,158	772	3,176	2,070	11.28	6
3011	MOTOR REP SHOP	1,955	1,173	782	3,217	2,070	11.58	6
3012	MOTOR REP SHOP	1,895	1,137	758	3,119	2,070	10.86	6
3013	MOTOR REP SHOP	2,373	1,424	949	3,905	2,415	12.55	7
3016	VEH PAINT SHOP	1,264	758	505	2,079	1,380	10.86	4
3020	MOTOR REP SHOP	1,412	847	565	2,324	1,380	13.59	4
3021	MOTOR REP SHOP	1,815	1,089	726	7,592	2,070	29.33	6
3030	MOTOR REP SHOP	1,228	736	491	2,020	1,725	5.70	5
3040	MTL & WDWK SH	2,526	1,515	1,010	7,711	3,105	20.67	9
3041	MOTOR REP SHOP	2,452	1,471	981	7,485	2,760	23.71	8
3042	MOTOR REP SHOP	1,467	880	586	4,477	1,725	22.16	5
3043	MOTOR REP SHOP	1,656	993	662	5,054	1,725	26.60	5
3050	MOTOR REP SHOP	969	581	387	2,958	1,035	25.65	3
3051	MOTOR REP SHOP	969	581	387	2,958	1,380	16.16	4
3055	GEN PURP WHSE	2,294	1,376	917	7,001	2,760	21.38	8
3056	GEN PURP WHSE	2,294	1,376	917	7,001	2,415	26.19	7
3057	ELEC MNT SHOP	2,310	1,386	924	7,052	2,760	21.63	8
3058	PO BRANCH	1,441	922	518	3,959	2,070	13.09	6
3401	QM REPAIR SHOP	4,956	2,973	1,982	15,126	5,520	24.08	16
3402	GEN PURP WHSE	1,242	745	497	3,792	1,035	36.36	3
3406	GEN PURP WHSE	2,861	1,716	1,144	8,733	3,450	21.31	10
3408	CALIBR & REP	2,513	1,508	1,005	10,514	3,105	26.13	9
3424	QM REPAIR SHOP	932	559	372	2,845	1,380	15.07	4
150	GEN PURP WHSE	2,825	1,695	1,130	11,821	3,105	30.91	9
175	MOTOR REP SHOP	994	596	397	4,162	1,035	33.34	3
270	OPS GEN PURP	638	408	229	2,403	1,035	14.04	3
290	MNT SHOP	169	101	67	279	690	6.09	2
291	GEN STOREHOUSE	497	298	198	2,079	690	21.90	2

Table 3-5. Reset Control Savings Shop and Warehouse, Kaiserslautern (continued)

BLDG	FUNCTION	BASELINE CONSUMPTION MBTU/YEAR	REVISED CONSUMPTION MBTU/YEAR	ANNUAL SAVINGS MBTU	ANNUAL SAVINGS $	COST $	SIR	NUMBER OF RESET CONTROLLERS
310	MOTOR REP SHOP	1,364	818	545	5,709	1,380	34.66	4
326	ELEC MNT SHOP	278	167	111	1,164	345	26.00	1
332	GEN STOREHOUSE	372	223	148	1,556	690	13.30	2
611	MSL ASY & TEST	344	206	137	1,441	1,380	.45	4
622	MOTOR REP SHOP	239	143	95	1,002	690	4.17	2
646	MOTOR REP SHOP	1,537	922	615	2,530	1,725	10.24	5
3000	WAREHOUSE	2,736	1,642	1,094	4,502	3,105	9.98	9
3006	MOTOR REPAIR	902	541	361	1,485	1,380	4.23	4
3009	MOTOR REPAIR	783	469	313	1,288	1,380	2.04	4
3029	QM REPAIR SHOP	2,486	1,491	994	10,401	2,760	30.47	8
3114	MOTOR REP SHOP	2,267	1,360	906	6,919	3,450	14.32	10
3115	SKILL DEV GEN	245	147	98	749	690	2.10	2
3116	MOTOR REP SHOP	2,286	1,372	914	6,979	2,415	26.07	7
3117	MOTOR REP SHOP	2,430	1,458	972	7,417	2,760	23.38	8
2855	MOTOR REP SHOP	1,028	616	411	4,301	1,380	23.07	4
2859	MOTOR REP SHOP	1,738	1,043	695	2,860	2,070	8.93	6
2872	GEN PURP WHSE	632	379	253	1,930	1,035	12.45	3
2877	GEN STOREHOUSE	422	253	168	1,289	690	12.50	2
2902	MOTOR REP SHOP	768	460	307	2,344	1,035	17.77	3
2909	GEN STOREHOUSE	294	176	117	899	690	5.00	2
2910	GEN STOREHOUSE	293	175	117	894	690	4.91	2
2911	GEN STOREHOUSE	293	175	117	894	690	4.91	2
2912	GEN STOREHOUSE	303	181	121	925	690	5.49	2
2942	MOTOR REP SHOP	393	236	157	1,647	690	14.79	2
TOTALS				79,072	560,168	251,893		730

3.1.1.3. Lighting System Modifications

During a survey of the Kaiserslautern facilities, numerous inefficient lighting types were noted and the following actions were investigated:

E1 - Replace existing fluorescent lamps and ballasts with high efficient fluorescent lamps and electronic ballasts.

E2 - Replace existing incandescent lighting fixtures with high efficient fluorescent lighting fixtures with electronic ballasts.

E3 - Replace existing mercury vapour 125 W and 250 W lights with high pressure sodium 150 W lights.

E4 - Replace existing mercury vapour 125 W and 400 W by high pressure sodium vapour 250 W lights.

Cost estimates were developed for each modification.

3.1.1.3.1. Modification, E1

The illumination level will remain approximately the same. The proposal has been analyzed by computer, using the following construction costs:

a) Fluorescent Lamp	(2)	$ 2.81
b) Electronic Ballast	(1)	$32.50
c) Labour		$15.63
Total		$50.94 say $ 51.00

Related to the existing lighting demand, this is a total of $ 510.00 per 1,000 W. The annual recurring savings will occur by reduction of the demand charges at $ 70./kW. Since these electronic ballast do not require any starters there will be a non-recurring cost saving as following:

a) Starters per 100 W	(2)	$1.17
b) Labour per 100 W, 12 minutes		$3.13
Total		$4.30

Related to existing lighting demand this is a total of $43 per 1,000 W. Replacement would be required every 4 years which results in a SPW factor of 0.76. The building affected are shown in Table E-2. The calculations shown in Table E-1 result in a total energy saving of 1,548 MWh/a equal to 17,967 MBTU/a with an overall SIR = 1.5.

3.1.1.3.2. Modification, E2

Replacing these incandescent lighting fixtures with high efficient fluorescent fixtures gains not only energy but also improves the illumination quality by approximately 150 percent. Energy savings are 65 percent related to a 100 W incandescent lighting fixture.

The construction costs will be as following:

a)	New fluorescent light fixture 2 x 32 W	(1)	$43.00
b)	High efficient fluorescent lamps	(2)	$ 2.81
c)	Labour		$15.63
	Total		$61.44 say $62.00

Related to existing lighting demand this is a total of $620 per 1.000 W.

Annual recurring savings will occur by reduction of the demand charges at $70./kW. There will also be non-recurring savings on maintenance as following:

a) Replacement of incandescent lamp every 1,000 hours, this means approximately 2,5 replacements per year.

1)	Lamp 100 W	(1)	$0.80
2)	Labor 15 Minutes		$3.90
	TOTAL		$4, 70 x 2, 5 x 0, 93 (SPW) = $10.93

b) Replacement of fluorescent lamp every 7,500 hours, this means approximately every three (3) years.

1)	Lamp 36 W	(2)	$2.81
2)	Labor 15 Minutes		$3.90
	TOTAL		$6.71 x 0.76 (SPW) = $ 5.10

The total discounted non-recurring savings will be $5.83 per 100 W related to existing lighting demand and $58.30 per 1,000 W. The total number of incandescent lighting has been estimated throughout the community with a total of approximately 2675. See Table E-3.

This will result in the following savings:

Total demand 2675 each x 100 W = 267500 W = 267.5 KW.

Demand savings will be 267.5 KW x 65 percent = 174 KW x $70./a = $12,180/a.

Based on an average operating hours of 2,500 hrs./a the annual energy savings will be 174 KW x 2,500 hours = 435 MWh/a, which is equal to 5,046 MBTU/a.

Construction cost will be 267.5 KW x 620 $/KW = $165,850.00

The total discounted non-recurring savings will be 267.5 KW x $58.30/KW = $ 15,595.00.

Savings ratio will be SIR = 2.21

3.1.1.3.3. Modification, E3

Replacement of existing mercury vapour lights 125 W and 250 W by high pressure sodium vapour lights 150 W.

Some spaces are equipped with mercury vapour lights 125 W and 250 W which are inefficient related to high pressure sodium vapour lights (HPS). Replacing these lights with 150 W HPS lights will result in energy savings of:

a) Existing mercury vapour	250 W + ballast 16 W = 266 W
b) New sodium vapour	150 W + ballast 20 W = 170 W
	96 W = 36 percent

The illumination level will remain approximately the same (Light current HQL 250 W = 13,500 LM/HPS 150 W = 14,000 LM).

The construction costs will be as following:

a)	HPS lamp 150 W	(1)	$29.00
b)	Ballast	(1)	$18.00
c)	Starter	(1)	$12.00
d)	Labour		$16.00
	Total per 250 W installed load		$75.00

This will be $300.00 per 1,000 W located load. Demand savings will be $70./a for each saved 1,000 W. There will be no non-recurring costs or savings.

The total existing 125 W and 250 W mercury vapour lights to be replaced by 150 HPS lights have been estimated throughout the community with approximately 1103 each. See Table E-4. This will result in the following savings:

Total demand 1103 x 266 W = 293,398 W = 293 KW

Demand savings will be 293 KW x 36 percent = 105 KW x $70./a = $7,350/a

Based on an average operating hours of 2,500 hours/a the annual energy savings will be 105 KW x 2,500 hours/a = 262.5 MWh/a which is equal to 3045 MBTU/a.

Construction costs will be 293 KW x $300./KW = $87,900. This will be an actual unit cost per 150 W HPS of 79.69 US $.

Savings ratio will be SIR = 2.54

3.1.1.3.4. Modification, E4

Replacement of existing mercury vapour lights 125 W and 400 W by high pressure sodium vapour lights 250 W.

Many spaces are equipped with mercury vapour lights 125 W and 400 W which are inefficient related to high pressure sodium vapour lights (HPS).

Replacing these lights with 250 W HPS lights will result in energy savings of:

a)	Existing mercury vapour (or 4 each 125 W)	400 W + ballast 25 W = 425 W (approx.)
b)	New HPS	250 W + ballast 25 W = 275 W
	Total	150 W = 37.5 percent

The illumination level will increase by 13.6 percent (MV = 22,000 LM/HPS = 25.000 LM)

The construction costs will be as following:

a)	HPS lamp 250 W	(1)	$33.00
b)	Ballast	(1)	$18.00
c)	Starter	(1)	$12.00
d)	Labour		$16.00
	Total per 400 W installed load		$79.00

This will be $197.5 per 1,000 W installed load. Demand savings will be $70./a for each saved KW. There will be no non-recurring costs or savings.

The total existing 125 W and 400 W mercury vapour lights to be replaced by 250 W HPS lights have been estimated throughout the community with approximately 970 each. See Table E-4. This will result in the following savings:

Total demand 970 x 400 W = 388,000 W = 388 KW.

Demand savings will be 388 KW x 145.5 percent = 211.5 KW x $70/a = 10,185/a.

Based on an average operating hours of 2,500 hours/a the annual energy savings will be 145.5 KW x 2,500 hours/a = 363.75 MWh/a = 4,220 MBTU/a.

Construction costs will be 388 KW x $197.5 = $76,630

The savings ratio will be SIR = 4.03.

3.1.1.3.5. Results.

Estimated Construction Cost, November 1983:	1,140,107	$
Annual Energy Savings:	30,278	MBTU
Total First Year Dollar Savings:	143,518	MBTU

Discounted Energy Savings:

1,580,129 $

Discounted Non Energy Savings:	590,030	$

Total Net Discounted Savings:

2,170,169 $

Discounted Savings Ratio: SIR = 1.95

L.A.DALY HANS DOENGES GmBH

ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

PACKAGE NO. 14

KAISERSLAUTERN COMMUNITY

ENERGY SAVINGS, COST ESTIMATE,
AND LIFE CYCLE COST ANALYSIS BY BUILDING
ITEM: REPLACEMENT OF EXISTING FLUORESCENT LAMPS
AND BALLASTS BY HIGH EFFICIENT FLOURESCENT
LAMPS AND ELECTRONIC BALLASTS.

TABLE: E1 - ALL BUILDINGS

LEGEND FOR TABLES ON FOLLOWING PAGES

DB/KW	-	DEMAND BEFORE
AC/KWh	-	ANNUAL CONSUMPTION BEFORE
AC/MBTU	-	ANNUAL CONSUMPTION BEFORE (MILLION BTU)
DS/KW	-	DEMAND SAVING
AS/KWh	-	ANNUAL SAVINGS AFTER
AS/MBTU	-	ANNUAL SAVINGS AFTER (MILLION BTU)
CC/$	-	CONSTRUCTION COST IN US$
IC/$	-	INVESTMENT COST IN US$
RCC/$	-	DISCOUNTED RECURRING COST IN US$
NRC/$	-	DISCOUNTED NON RECURRING COST IN US$
NDS/$	-	NET DISCOUNTED SAVINGS IN US$
SIR	-	SAVINGS RATIO

L.A.DALY HANS DOENGES GmbH

EEAP PACKAGE 14, KAISERSLAUTERN, COMMUNITY SUMMARY
ELECTRICAL ENERGY SAVINGS AND CONSTRUCTION COST ESTIMATE BY BUILDING

PROPOSAL E 1 / SC: 30%

GY NO.	DB/KW	AC/KWh	AC/MBTU	DS/KW	AS/KWh	AS/MBTU	CC/$	IC/$	RCC/$	NRC/$	NDS/$	SIR
GY072	4.8	17520	203	1.44	5257	62	2448	2468	918	158	4311	1.7
GY298	131.6	382682	4438	39.47	114803	1334	67116	67652	25176	4301	99095	1.4
GY380	346.4	1151811	13358	103.91	345543	4008	176664	178077	66268	11318	286759	1.6
GY382	652.0	2197418	25494	195.60	659229	7646	332520	335180	124737	21309	545065	1.6
GY455	64.6	184756	2143	19.38	55427	644	32946	33209	12357	2112	48078	1.4
GY490	37.2	109512	1270	11.16	32854	381	18972	19123	7117	1215	28216	1.4
GY542	201.4	590422	6851	60.42	177128	2057	102715	103538	38533	6576	152463	1.4
GY565	10.8	25636	297	3.24	7691	90	5508	5552	2066	353	7116	1.2
GY680	138.8	501160	5813	41.66	150350	1745	70829	71395	26569	4538	122177	1.7
GY744	0.0	0	0	0.00	0	0	0	0	0	0	0	0.0
TOTAL	1587.6	5160917	59807	476.30	1548282	17967	809718	816194	303741	51880	1293280	1.5

L.A.DALY HANS DOENGES GmbH

EEAP PACKAGE 14, KAISERSLAUTERN ,GY 680 AND 741 DAENNER
ELECTRICAL ENERGY SAVINGS AND CONSTRUCTION COST ESTIMATE BY BUILDING

PROPOSAL E 1 / SC: 30%

BLDG	DB/KW	AC/KWh	AC/MBTU	DS/KW	AS/KWh	AS/MBTU	CC/$	IC/$	RCC/$	NRC/$	NDS/$	SIR
3100	32.9	120085	1393	9.87	36026	418	16779	16913	6294	1075	29184	1.7
3101	32.9	120085	1393	9.87	36026	418	16779	16913	6294	1075	29184	1.7
3102	32.9	120085	1393	9.87	36026	418	16779	16913	6294	1075	29184	1.7
3103	32.9	120085	1393	9.87	36026	418	16779	16913	6294	1075	29184	1.7
3113	2.9	8294	96	0.86	2488	29	1479	1491	555	95	2163	1.4
3115	2.0	5720	66	0.60	1716	20	1020	1028	383	65	1492	1.4
3117	2.3	6806	79	0.71	2042	24	1214	1224	455	78	1786	1.4
TOTAL	138.8	501160	5813	41.66	150350	1745	70829	71395	26569	4538	122177	1.7

L.A.DALY HANS DOENGES GmbH

EEAP PACKAGE 14, KAISERSLAUTERN ,BANN GY 072
ELECTRICAL ENERGY SAVINGS AND CONSTRUCTION COST ESTIMATE BY BUILDING

PROPOSAL E 1 / SC: 30%

BLDG	DB/KW	AC/KWh	AC/MBTU	DS/KW	AS/KWh	AS/MBTU	CC/$	IC/$	RCC/$	NRC/$	NDS/$	SIR
2615	1.7	6205	72	0.51	1862	22	867	874	325	56	1529	1.7
2618	1.7	6205	72	0.51	1862	22	867	874	325	56	1529	1.7
2619	1.4	5110	59	0.42	1533	18	714	720	268	46	1253	1.7
TOTAL	4.8	17520	203	1.44	5257	62	2448	2468	918	158	4311	1.7

L.A.DALY HANS DCENGES GmbH

EEAP PACKAGE 14, KAISERSLAUTERN ,GY 298 ARMY DEPOT
ELECTRICAL ENERGY SAVINGS AND CONSTRUCTION COST ESTIMATE BY BUILDING

PROPOSAL E 1 / SC: 30%

BLDG	DB/KW	AC/KWh	AC/MBTU	DS/KW	AS/KWh	AS/MBTU	CC/$	IC/$	RCC/$	NRC/$	NDS/$	SIR
2200	33.0	94380	1095	9.90	28314	328	16830	16965	6313	1078	24509	1.4
2227	1.3	3718	43	0.38	1115	13	663	668	249	42	970	1.4
2246	1.4	4004	46	0.41	1201	14	714	720	268	46	1044	1.4
2256	8.1	23166	269	2.43	6950	81	4131	4164	1550	265	6042	1.4
2257	2.2	6292	73	0.66	1888	22	1122	1131	421	72	1641	1.4
2277	2.4	6864	80	0.71	2059	24	1224	1234	459	78	1790	1.4
2281	29.0	82940	962	8.70	24882	289	14790	14908	5548	948	21578	1.4
2293	7.5	21450	249	2.25	6435	75	3825	3856	1435	245	5594	1.4
2300	2.5	7150	83	0.75	2145	25	1275	1285	478	82	1865	1.4
2303	1.4	4004	46	0.41	1201	14	714	720	268	46	1044	1.4
2329	3.2	9152	106	0.96	2746	32	1632	1645	612	105	2387	1.4
2362	1.0	2860	33	0.30	858	10	510	514	191	33	746	1.4
2374	7.3	20878	242	2.18	6263	73	3723	3753	1396	239	5445	1.4
2388	7.0	20020	232	2.10	6006	70	3570	3599	1339	229	5221	1.4
2389	6.0	17160	199	1.80	5148	60	3060	3084	1148	196	4475	1.4
2410	1.3	3718	43	0.38	1115	13	663	668	249	42	970	1.4
2414	1.8	5148	60	0.53	1544	18	918	925	344	59	1342	1.4
2418	1.8	6570	76	0.54	1971	23	918	925	344	59	1603	1.7
2420	1.6	5840	68	0.48	1752	20	816	823	306	52	1402	1.7
2422	4.5	15210	176	1.35	4563	53	2295	2313	861	147	3774	1.6
2425	4.0	11440	133	1.20	3432	40	2040	2056	765	131	2983	1.4
2426	1.3	3718	43	0.38	1115	13	663	668	249	42	970	1.4
2427	2.0	7000	81	0.60	2100	24	1020	1028	383	65	1700	1.6
TOTAL	131.6	382682	4438	39.47	114803	1334	67116	67652	25176	4301	99095	1.4

L.A.DALY HANS DOENGES GmbH

EEAP PACKAGE 14, KAISERSLAUTERN ,GY 380 KLEBER
ELECTRICAL ENERGY SAVINGS AND CONSTRUCTION COST ESTIMATE BY BUILDING

PROPOSAL E 1 / SC: 30%

BLDG	DB/KW	AC/KWh	AC/MBTU	DS/KW	AS/KWh	AS/MBTU	CC/$	IC/$	RCC/$	NRC/$	NDS/$	SIR
3200	36.2	132130	1533	10.86	39639	460	18462	18610	6925	1183	32115	1.7
3206	11.0	37180	431	3.30	11154	129	5610	5655	2104	359	9196	1.6
3208	24.0	68640	796	7.20	20592	239	12240	12338	4591	784	17849	1.4
3209	27.4	100010	1160	8.22	30003	348	13974	14086	5242	895	24299	1.7
3210	27.4	100010	1160	8.22	30003	348	13974	14086	5242	895	24299	1.7
3211	36.5	104390	1211	10.95	31317	363	18615	18764	6983	1193	27120	1.4
3212	19.8	61776	717	5.94	18533	215	10098	10179	3788	647	15655	1.5
3213	28.5	104025	1207	8.55	31208	362	14535	14651	5452	931	25276	1.7
3221	2.9	8294	96	0.86	2488	29	1479	1491	555	95	2163	1.4
3222	1.2	3120	36	0.36	936	11	612	617	230	39	843	1.3
3225	11.8	33748	391	3.53	10124	117	6018	6066	2257	386	8749	1.4
3226	6.0	17160	199	1.80	5148	60	3060	3084	1148	196	4475	1.4
3227	23.0	83950	974	6.90	25185	292	11730	11824	4400	752	20390	1.7
3229	7.9	22594	262	2.36	6778	79	4029	4061	1511	258	5892	1.4
3230	3.5	10010	116	1.05	3003	35	1785	1799	670	114	2611	1.4
3231	8.0	24960	290	2.40	7488	87	4080	4113	1530	261	6332	1.5
3234	1.0	2860	33	0.30	858	10	510	514	191	33	746	1.4
3242	13.0	47450	550	3.90	14235	165	6630	6683	2487	425	11523	1.7
3243	10.2	34476	400	3.06	10343	120	5202	5244	1951	333	8547	1.6
3246	19.8	72270	838	5.94	21681	251	10098	10179	3788	647	17534	1.7
3247	4.5	15210	176	1.35	4563	53	2295	2313	861	147	3774	1.6
3252	2.0	5720	66	0.60	1716	20	1020	1028	383	65	1492	1.4
3254	3.3	9438	109	0.98	2331	33	1683	1696	631	108	2461	1.4
3255	4.5	15210	176	1.35	4563	53	2295	2313	861	147	3774	1.6
3266	13.0	37180	431	3.90	11154	129	6630	6683	2487	425	9644	1.4
TOTAL	346.4	1151811	13358	103.91	345543	4008	176664	178077	66268	11318	286759	1

L.A.DALY HANS DOENGES GmbH

EEAP PACKAGE 14, KAISERSLAUTERN ,GY 382 LANDSTUHL
ELECTRICAL ENERGY SAVINGS AND CONSTRUCTION COST ESTIMATE BY BUILDING

PROPOSAL E 1 / SC: 30%

BLDG	DB/KW	AC/KWh	AC/MBTU	DS/KW	AS/KWh	AS/MBTU	CC/$	IC/$	RCC/$	NRC/$	NDS/$	SIR
3701	10.9	31174	362	3.26	9352	108	5559	5603	2085	356	8078	1.4
3702	24.7	90155	1046	7.41	27047	314	12597	12698	4725	807	21919	1.7
3703	16.9	48334	561	5.06	14500	168	8619	8688	3233	552	12553	1.4
3704	2.8	10220	119	0.84	3066	36	1428	1439	536	92	2506	1.7
3707	24.7	90155	1046	7.41	27047	314	12597	12698	4725	807	21919	1.7
3716	24.7	90155	1046	7.41	27047	314	12597	12698	4725	807	21919	1.7
3719	4.0	11440	133	1.20	3432	40	2040	2056	765	131	2933	1.4
3736	2.6	9490	110	0.78	2847	33	1326	1337	497	85	2305	1.7
3737	4.2	12012	139	1.26	3604	42	2142	2159	804	137	3133	1.4
3741	2.6	7436	86	0.78	2231	26	1326	1337	497	85	1939	1.4
3757	50.0	182500	2117	15.00	54750	635	25500	25704	9566	1634	44338	1.7
3758	32.0	91520	1062	9.60	27456	318	16320	16451	6122	1046	23763	1.4
3760	32.0	99840	1158	9.60	29952	347	16320	16451	6122	1046	25277	1.5
3762	50.0	182500	2117	15.00	54750	635	25500	25704	9566	1634	44338	1.7
3725	17.0	62050	720	5.10	18615	216	8670	8739	3252	556	15080	1.7
3763	6.0	21900	254	1.80	6570	76	3060	3084	1148	196	5310	1.7
3764	32.0	99840	1158	9.60	29952	347	16320	16451	6122	1046	25277	1.5
3765	4.0	14600	169	1.20	4380	51	2040	2056	765	131	3558	1.7
3766	29.8	108770	1262	8.94	32631	379	15198	15320	5701	974	26454	1.7
3767	50.0	156000	1810	15.00	46800	543	25500	25704	9566	1634	39537	1.5
3769	32.0	116800	1355	9.60	35040	406	16320	16451	6122	1046	28356	1.7
3770	32.0	116800	1355	9.60	35040	406	16320	16451	6122	1046	28356	1.7
3771	32.0	91520	1062	9.60	27456	318	16320	16451	6122	1046	23763	1.4
3772	50.0	182500	2117	15.00	54750	635	25500	25704	9566	1634	44338	1.7
3774	20.5	63960	742	6.15	19183	223	10455	10539	3922	670	16230	1.5

L.A.DALY HANS DOENGES GmbH

EEAP PACKAGE 14, KAISERSLAUTERN ,GY 382 LANDSTUHL
ELECTRICAL ENERGY SAVINGS AND CONSTRUCTION COST ESTIMATE BY BUILDING

PROPOSAL E 1 / SC: 30%

BLDG	DB/KW	AC/KWh	AC/MBTU	DS/KW	AS/KWh	AS/MBTU	CC/$	IC/$	RCC/$	NRC/$	NDS/$	SIR
3776	4.0	11440	133	1.20	3432	40	2040	2056	765	131	2983	1.4
3792	9.0	28080	326	2.70	8424	98	4590	4627	1722	294	7130	1.5
3813	6.7	24455	284	2.01	7337	85	3417	3444	1282	219	5937	1.7
3815	6.7	24455	284	2.01	7337	85	3417	3444	1282	219	5937	1.7
3817	2.0	5720	66	0.60	1716	20	1020	1028	383	65	1492	1.4
3818	5.8	15080	175	1.74	4524	52	2958	2982	1110	190	4013	1.3
3819	5.0	9100	106	1.50	2730	32	2550	2570	957	163	2790	1.0
3820	6.7	19162	222	2.01	5749	67	3417	3444	1282	219	4997	1.4
3821	6.0	21900	254	1.80	6570	76	3060	3084	1148	196	5310	1.7
3823	6.0	21900	254	1.80	6570	76	3060	3084	1148	196	5310	1.7
3824	6.7	24455	284	2.01	7337	85	3417	3444	1282	219	5937	1.7
TOTAL	652.0	2197418	25494	195.60	659229	7646	332520	335180	124737	21309	545065	1.6

L.A.DALY HANS OCENGES GmbH

EEAP PACKAGE 14, KAISERSLAUTERN ,GY 455 EQUIP SUPT CTR
ELECTRICAL ENERGY SAVINGS AND CONSTRUCTION COST ESTIMATE BY BUILDING

PROPOSAL E 1 / SC: 30%

BLDG	DB/KW	AC/KWh	AC/MBTU	DS/KW	AS/KWh	AS/MBTU	CC/$	IC/$	RCC/$	NRC/$	NOS/$	SIR
3007	4.0	11440	133	1.20	3432	40	2040	2056	765	131	2983	1.4
3011	3.5	10010	116	1.05	3003	35	1785	1799	670	114	2611	1.4
3012	2.2	6292	73	0.66	1888	22	1122	1131	421	72	1641	1.4
3013	2.4	6864	80	0.71	2059	24	1224	1234	459	78	1790	1.4
3030	5.5	15730	182	1.65	4719	55	2805	2827	1052	180	4102	1.4
3042	4.0	11440	133	1.20	3432	40	2040	2056	765	131	2983	1.4
3043	14.0	40040	464	4.20	12012	139	7140	7197	2678	458	10390	1.4
3055	20.0	57200	664	6.00	17160	199	10200	10282	3826	654	14865	1.4
3058	8.0	22880	265	2.40	6864	80	4080	4113	1530	261	5967	1.4
3091	1.0	2860	33	0.30	858	10	510	514	191	33	746	1.4
TOTAL	64.6	184756	2143	19.38	55427	644	32946	33209	12357	2112	48078	1.4

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EEAP PACKAGE 14, KAISERSLAUTERN ,GY 490 ESELSFUERTH QM FAC
ELECTRICAL ENERGY SAVINGS AND CONSTRUCTION COST ESTIMATE BY BUILDING

PROPOSAL E 1 / SC: 30%

BLDG	DB/KW	AC/KWh	AC/MBTU	DS/KW	AS/KWh	AS/MBTU	CC/$	IC/$	RCC/$	NRC/$	NDS/$	SIR
3402	13.6	38896	451	4.08	11669	135	6936	6991	2602	444	10092	1.4
3403	12.0	37440	434	3.60	11232	130	6120	6169	2296	392	9472	1.5
3408	9.1	26026	302	2.73	7808	91	4641	4678	1741	297	6787	1.4
3409	2.5	7150	83	0.75	2145	25	1275	1285	478	82	1865	1.4
TOTAL	37.2	109512	1270	11.16	32854	381	18972	19123	7117	1215	28216	1.4

L.A.DALY HANS DOENGES GmbH

EEAP PACKAGE 14, KAISERSLAUTERN ,GY 542 RHINE ORD BARRACKS
ELECTRICAL ENERGY SAVINGS AND CONSTRUCTION COST ESTIMATE BY BUILDING

PROPOSAL E 1 / SC: 30%

BLDG	DB/KW	AC/KWh	AC/MBTU	DS/KW	AS/KWh	AS/MBTU	CC/$	IC/$	RCC/$	NRC/$	NDS/$	SIR
163	9.0	30420	353	2.70	9126	106	4590	4627	1722	294	7548	1.6
164	24.7	70642	819	7.41	21193	246	12597	12698	4725	807	18371	1.4
175	10.0	28600	332	3.00	8580	100	5100	5141	1913	327	7459	1.4
179	13.4	38324	445	4.01	11497	133	6834	6889	2564	438	9942	1.4
273	2.7	9855	114	0.81	2957	34	1377	1388	517	88	2379	1.7
274	2.7	9855	114	0.81	2957	34	1377	1388	517	88	2379	1.7
275	2.7	9855	114	0.81	2957	34	1377	1388	517	88	2379	1.7
281	1.4	3770	44	0.43	1131	13	740	746	277	47	1003	1.3
288	1.7	4862	56	0.51	1459	17	867	874	325	56	1268	1.4
289	5.0	18250	212	1.50	5475	64	2550	2570	957	163	4460	1.7
290	1.3	3718	43	0.38	1115	13	663	668	249	42	970	1.4
292	3.0	8580	100	0.90	2574	30	1530	1542	574	98	2238	1.4
310	6.4	18304	212	1.91	5491	64	3264	3290	1224	209	4773	1.4
332	3.0	8580	100	0.90	2574	30	1530	1542	574	98	2238	1.4
335	0.6	1859	22	0.19	558	6	332	335	124	21	459	1.3
336	1.3	3718	43	0.38	1115	13	663	668	249	42	970	1.4
339	1.5	4290	50	0.45	1287	15	765	771	287	49	1119	1.4
344	2.1	6006	70	0.63	1802	21	1071	1080	402	69	1566	1.4
346	0.9	2340	27	0.27	702	8	459	463	172	29	619	1.3
347	4.2	12012	139	1.26	3604	42	2142	2159	804	137	3133	1.4
369	2.4	6864	80	0.71	2059	24	1224	1234	459	78	1790	1.4
370	2.4	6864	80	0.71	2059	24	1224	1234	459	78	1790	1.4
371	2.4	6864	80	0.71	2059	24	1224	1234	459	78	1790	1.4
372	3.6	10296	119	1.08	3089	36	1836	1851	689	118	2685	1.4
611	50.0	143000	1659	15.00	42900	498	25500	25704	9566	1634	37189	1.4

L.A.DALY HANS DOENGES GmbH

EEAP PACKAGE 14, KAISERSLAUTERN ,GY 542 RHINE ORD BARRACKS
ELECTRICAL ENERGY SAVINGS AND CONSTRUCTION COST ESTIMATE BY BUILDING

PROPOSAL E 1 / SC: 30%

BLDG	DB/KW	AC/KWh	AC/MBTU	DS/KW	AS/KWh	AS/MBTU	CC/$	IC/$	RCC/$	NRC/$	NDS/$	SIR
622	6.5	18590	216	1.95	5577	65	3315	3342	1244	212	4848	1.4
637	4.6	13156	153	1.38	3947	46	2346	2365	880	150	3431	1.4
646	3.5	10010	116	1.05	3003	35	1785	1799	670	114	2611	1.4
690	16.4	46904	544	4.91	14071	163	8364	8431	3137	536	12180	1.4
695	5.0	14300	166	1.50	4290	50	2550	2570	957	163	3729	1.4
701	5.4	15444	179	1.61	4633	54	2754	2776	1033	176	4028	1.4
705	1.5	4290	50	0.45	1287	15	765	771	287	49	1119	1.4
TOTAL	201.4	590422	6851	60.42	177128	2057	102715	103538	38533	6576	152463	1.4

L.A.DALY HANS DOENGES GmbH

EEAP PACKAGE 14, KAISERSLAUTERN ,GY 565 PANZER
ELECTRICAL ENERGY SAVINGS AND CONSTRUCTION COST ESTIMATE BY BUILDING

PROPOSAL E 1 / SC: 30%

BLDG	DB/KW	AC/KWh	AC/MBTU	DS/KW	AS/KWh	AS/MBTU	CC/$	IC/$	RCC/$	NRC/$	NDS/$	SIR
3000	9.4	21996	255	2.82	6599	77	4794	4832	1798	307	6124	1.2
3019	1.4	3640	42	0.42	1092	13	714	720	268	46	992	1.3
TOTAL	10.8	25636	297	3.24	7691	90	5508	5552	2066	353	7116	1.2

Table E-2. Building Quantity Summary for E-1

GY 072	Bldg. No.	2615	Fixtures	17	
		2618		17	
		2619		14	
Total					48
GY 298	Bldg. No.	2200	Fixtures	330	
		2227		13	
		2246		14	
		2256		80	
		2257		22	
		2277		24	
		2281		290	
		2293		75	
		2300		25	
		2303		14	
		2329		32	
		2362		10	
		2374		73	
		2388		70	
		2389		60	
		2410		13	
		2414		18	
		2418		18	
		2420		16	
		2422		45	
		2425		40	
		2426		13	
		2427		20	
Total					1,315
GY 380	Bldg. No.	3200	Fixtures	362	
		3206		110	
		3208		240	
		3209		274	
		3210		274	
		3211		365	
		3212		198	
		3213		285	
		3221		29	
		3222		12	
		3225		118	
		3226		60	
		3227		230	
		3229		79	
		3230		35	
		3231		80	
		3234		10	

GY 380 (continued)		3242		130	
		3243		102	
		3246		198	
		3247		45	
		3252		20	
		3254		33	
		3255		45	
		3266		130	
Total					3,464
GY 382	Bldg. No.	3701	Fixtures	109	
		3702		247	
		3703		169	
		3704		28	
		3707		247	
		3716		247	
		3719		40	
		3736		26	
		3737		42	
		3741		26	
		3757		500	
		3758		320	
		3760		320	
		3762		500	
		3725		170	
		3263		60	
		3264		320	
		3265		40	
		3266		298	
		3267		500	
		3269		320	
		3270		320	
		3271		320	
		3272		500	
		3274		205	
		3776		40	
		3792		90	
		3813		67	
		3815		67	
		3817		20	
		3818		58	
		3819		50	
		3820		67	
		3821		60	
		3823		60	
		3824		67	
Total					6,520

GY 455	Bldg. No.	3007	Fixtures	40	
		3011		35	
		3012		22	
		3013		24	
		3030		55	
		3042		40	
		3043		140	
		3055		200	
		3758		80	
		3891		10	
Total					646
GY 490	Bldg. No.	3402	Fixtures	136	
		3403		120	
		3408		91	
		3409		25	
Total					372
GY 542	Bldg. No.	163	Fixtures	90	
		164		247	
		175		100	
		179		134	
		273		27	
		274		27	
		275		27	
		281		15	
		288		17	
		289		50	
		290		13	
		292		30	
		310		64	
		332		30	
		335		7	
		336		13	
		339		15	
		344		21	
		346		9	
		347		42	
		369		24	
		370		24	
		371		24	
		372		36	
		611		500	
		622		65	
		637		46	
		646		35	
		690		164	
		695		50	
		701		54	
		705		15	
Total					2,015
GY 565	Bldg. No.	3000	Fixtures	94	
		3019		14	
Total					108

GY 68 & 741 Bldg. No.	3100	Fixtures	329	
	3101		329	
	3102		329	
	3103		329	
	3113		29	
	3115		20	
	3117		24	
Total				1,389
GRAND TOTAL				15,877

Table E-3. Building Quantity Summary

GY 298	Bldg. No.	2215	each/100 W incandescent	12	
		2229		24	
		2230		24	
		2232		10	
		2280		110	
		2306		52	
		2312		89	
		2363		58	
		2408		61	
		2409		19	
		2411		63	
		2412		63	
		2421		63	
		2423		63	
		2419		14	
		2420		16	
		2426		14	
Total					755
GY 382	Bldg. No.	3814	each/100 W incandescent	45	
		3880		74	
		3794		70	
		3800		96	
Total					285
GY 455		3457	each/100 W incandescent	33	
Total					33
GY 490	Bldg. No.	3403	each/100 W incandescent	118	
		3404		55	
		3406		245	
		3416		120	
		3424		130	
Total					668
GY 542		026	each/100 W incandescent	49	
Total					49
GY 565		3033	each/100 W incandescent	14	
Total					14
GY 741		3150	each/100 W incandescent	19	
Total					19

Table E-3. Building Quantity Summary (continued)

GY 744	Bldg. No.	2850	each/100 W incandescent	6	
		2885		7	
		2909		12	
		2917		32	
		2918		40	
		2919		40	
		2921		40	
		2922		40	
Total					217
GY 374		3188	each/100 W incandescent	635	
Total					635
GRAND TOTAL					2,675

Table E-4. Buildings Quantity Summary for E-3 and E-4

	BLDG. NO.	MERC. EXIST.	HPS REPLACE	QUANTITIES E-3	E-4
GY 298	2213	25-125	12-150	12	
	2219	44-125	22-150	22	
	2225	35-125	18-150	18	
	2226	15-250	15-150	15	
	2229	5-250	5-150	5	
	2230	5-250	5-150	5	
	2232	5-250	5-150	5	
	2238	32-400	32-250		32
	2239	42-400	42-250		42
	2240	8-250	8-150	8	
	2247	12-250	12-150	12	
	2248	25-250	25-150	25	
	2249	25-250	25-150	25	
	2251	25-250	25-150	25	
	2258	35-400	25-250		35
	2260	40-400	40-250		40
	2264	40-400	40-250		40
	2267	16-400	16-250		16
	2268	8-250	8-150	8	
	2288	18-125	9-150	9	
	2289	8-250	8-150	8	
	2306	14-125	7-150	7	
	2312	4-400	4-250		4
	2317	8-250	8-150	8	
	2318	8-250	8-150	8	
	2324	87-250	87-250	87	
	2330	8-250	8-150	8	
	2331	8-250	8-150	8	
	2335	8-250	8-150	8	
	2338	8-250	8-150	8	
	2339	8-250	8-150	8	
	2370	55-400	55-250		55
	2385	120-125	30-250		30
	2386	40-250	40-150	40	
	2387	40-125	20-150	20	
	2393	44-125	21-150	22	
	2394	12-125	6-150	6	
	2233A/2233B	83-400	83-250		83
	2369A	24-250	24-150	24	
	2369B	85-400	85-250		85
	2371A/2371B	400-400	260-250		260
	2372A/2372B	98-400	98-250		98
	2433	35-400	35-250		35
Total				464	855

Table E-4. Buildings Quantity Summary for E-3 and E-4 (continued)

	BLDG. NO.	MERC. EXIST.	HPS REPLACE	QUANTITIES E-3	QUANTITIES E-4
GY 455	3014	12-250	12-150	12	
	3040	3-400	3-250		3
	3041	52-400	52-250		52
	3042	7-250	7-250	7	
	3043	35-400	35-250		35
	3056	60-250	60-150	60	
	3058	16-250	16-150	16	
Total				95	90
GY 490	3400	20-125	6-250		6
Total				0	6
GY 542	150	39-125	10-250		10
	225	42-250	42-150	42	
	226	42-250	42-150	42	
	231	42-250	42-150	42	
	227	42-250	42-150	42	
	228	42-250	42-150	42	
	229	42-250	42-150	42	
	230	42-250	42-150	42	
	235	42-250	42-150	42	
	236	42-250	42-150	42	
	237	42-250	42-150	42	
	270	9-400	9-250		9
	630	124-250	124-150	124	
Total				544	19
TOTAL GY 298:				464	855
GY 455:				95	90
GY 490:				0	6
GY 542:				544	19
GRAND TOTAL				1,103	970

3.1.2. Boiler Plants.

The Kaiserslautern Community is mainly heated by central boiler plants. The total fuel consumption of these plants was approximately 690,000 MBTU/a representing approximately 80 percent of the total FY 82 heating fuel consumption. The heating fuel consumption will be approximately constant between FY 82 and FY 87, due to the programmed building projects which will compensate for the decreasing trend as a result of the DEH energy conservation measures performed during FY 75 through FY 82.

DEH has programmed or under construction a number of boiler plant modifications that will improve plant efficiencies and also decrease costs by converting to more economical fuels. However, it is recommended the DEH review their programs of plant modifications and compare plant capacities with the future energy requirements that will result from the implementation of this study. If the ECIP and maintenance and repair projects are implemented, there will be a dramatic reduction in energy use. This would leave a number of the plants with a substantial excess capacity and a subsequent reduction in boiler efficiencies. This review must also be coordinated with the community development plans.

The majority of the proposed ECOs analyzed have an SIR ratio of less than 1.0, due to the fact that the calculated energy savings gained by this ECOs are based on the energy consumption of the connected buildings after implementation of the proposed ECIP projects. Those ECOs with SIRs greater than 1.0, total less than $200,000 and are included in Section 3.3.

3.1.3. Distribution Systems.

DEH has also extensive projects under construction or programmed for replacing all substandard heat distribution lines, which means that no further actions are required under this study.

3.1.4. District Heat.

The City of Kaiserslautern has a limited network of district heat with a total capacity of approximately 350 million BTUH. This is the same as the FY 82 demand for the U.S. Military Community. No spare capacity is presently available.

3.1.5. Energy Monitoring and Control System.

3.1.5.1. General.

The evaluation of installing an Energy Monitoring and Control System within the Kaiserslautern Community resulted in the project qualifying for ECIP criteria:

PROJECT DESCRIPTION	COST	ANNUAL SAVINGS MBTU	ANNUAL SAVINGS $	SIR
EMCS	$1,830,428	41,520	310,925	1.9

3.1.5.2. Application.

The sections of the Kaiserslautern Community which have been studied for EMCS can be combined into three areas:

Area 1: GY 072 Bann
GY 382 Landstuhl Hospital

Area 2: GY 542 Rhine Ordnance Barracks
GY 744 Pulaski Barracks

Area 3: GY 298 Army Depot
GY 380 Kleber Kaserne
GY 455 Equipment Support Center
GY 490 QM FAC Eselsfuerth
GY 565 Panzer Kaserne
GY 680/741 Daenner Kaserne

Area 1.

The Bann Facility consists only of three major buildings and was not considered for EMCS application. The Landstuhl Hospital has been investigated for a stand-alone EMCS system. The master control room (MCR) is proposed to located in Building 3777. This would be System 1, a small EMCS.

Area 2.

Since GY 542 and GY 744 are still within the city limits, they have been only studied to be operated from the proposed master control room (MCR) in Building 3104, Daenner Kaserne.

Area 3.

All facilities within this areas have been studied to be operated from the central MCR in Daenner Kaserne. This would be system 2, a medium EMCS.

3.1.5.3. Basis of Analysis.

Each building has been analyzed on the basis of TM 5-815-2/AFM 88-36/NAVFAC DM 4.9 Energy Monitoring and Control Systems, Final Copy, May 1982 and HNDSP 83-049-ED-ME EMCS Cost Estimating Guidelines, February 1983.

Table EMCS-11 includes only those buildings with SIR 1.0 and above.

3.1.5.4. System Configuration.

Based on the remaining buildings with SIR 1.0 and above the EMCS has been layed out with the required Field Interface Devices (FID) and central components on the philosophy described in Application.

3.1.5.5. Software Functions.

The following software functions have been selected for the EMCS on the basis that local controls as described under Item 3.1.1.2. have

first and EMCS has second priority. This means that the savings gained by EMCS are based on the annual heating consumption after the deduction of those savings gained by local controls.

3.1.5.5.1. Scheduled Start/Stop.

This function will not result in any further energy savings, other than those already gained by local controls.

3.1.5.5.2. Summer/Winter Operation.

This function shall shut down heating systems during periods where the outdoor temperature is above 15° C./59° F. Based on the computer simulation, a savings of 3.5 percent annual heating energy savings could be realized.

3.1.5.5.3. Optimum Start/Stop.

Experience has shown, that this function will result in additional annual shut-off periods of approximately 0.5 hours/day over the whole year, which results in 183 hours/a, with an annual heating saving constant of:

3.5 percent/2,394 hours x 183 hours = 0.27 percent

The electrical energy saving constant will be:

183 hours x 0.5 kW = 91.5 kWh/a for shut-off the heating recirculation pump.

This function will also be used to shut-off domestic HW-heater recirculating pumps (average 0.25 kW each) at non-consuming hours which represents a saving constant of approximately 0.73 percent of the annual heating consumption.

The electrical savings result in:

8 hours/day x 365 days x 0,25 kW/pump = 730 kWh/a.

3.1.5.5.4. Duty Cycle.

No savings can be gained for the type of buildings included in this project.

3.1.5.5.5. Day/Night Setback.

This function will not result in any further energy savings, other than those already gained by local controls.

3.1.5.5.6. Demand Limiting.

The savings constant for all GYs will be 70$/kW/a. This EMCS function shall perform the following during high demand periods:

- Shut down of electrical domestic HW heater.
- Shut down of dryers.
- Shut down of ranges and other kitchen equipment.

This constant can be applied for each DHW-heater kW and for each dyer kW if those will be shut down during short high demand periods.

3.1.5.5.7. Lighting Controls.

The total lighting consumption of the Kaiserslautern Community in FY 82 was approximately 16,170 MWH. During site survey, it was observed that a total of 44 buildings were lighted during unoccupied operation, which represent approximately 11 percent of the total number of buildings. Experience has shown that local time clock controls are being by-passed by the overriding controls and that only a centralized EMCS control function will drastically reduce lighting consumption. It will be assumed that the electrical energy savings gained by this function will be eight (8) percent because these buildings are unoccupied about 75 percent of the time.

3.1.5.5.8. Maintenance Function.

The EMCS will provide continuous information over the status of the entire systems connected to it. It will instantaneously annunciate if local control functions are in overside (Hand) position, if pumps or control valves are in functional operation and will save energy and maintenance effort for this reason.

During a site survey at Hanau, in ten (10) percent of the total buildings, the control switch was found to be in the hand-position.

This would be a heating energy loss of approximately 10,000 MBTU/a. Based on the anticipated savings of 100,000 MBTU for night setback, this represents approximately five (5) percent of the total heating energy consumption after local controls have been installed. Experience shows that the percentage of control panels being in override (hand) position is much higher, especially after drastic energy conservation measures like room temperature in administrative buildings to be reduced to 18° C./65° F., or space temperatures in work shops to be 13° C./55° F. have been executed. For these reasons, this study uses a savings constant of five (5) percent for overall savings by better and instantaneous maintenance and monitoring possibilities.

3.1.5.6. Summary of Savings Constants.

The following is a summary of savings constants.

FUNCTION	HEATING ENERGY	ELEC. ENERGY	ELEC. DEMAND
Summer/Winter Oper.	(Heat) 3.5%	1,197 kWh/pump	
Optimum Start/Stop	(Heat) 0,27%	91.5 kWh/pump	
Demand Limiting			70$/kW
Lighting Control		8 percent	
Maintenance	5.0%		

Annual Savings, Total Heating Energy Saving Constant: 9.54% of the annual consumption.

Lighting Energy Savings Constant: 8% of the annual lighting consumption.

Electrical Energy Savings Constant for Each Heating Recirculating Pump: 1,197 + 91.5 = 1,288.5 kWh = 14.95 MBTU

For each DWH recirculating pump: 730 kWh = 8.47 MBTU

Demand limiting savings constant: 70$/kW

3.1.5.7. Construction Cost.

From the construction cost estimate the construction cost of the EMCS system is $1,807,830.

3.1.5.8. Discounted Savings Ratio.

The SIR is 1.9 and thus does qualify for ECIP.

L.A.DALY HANS DOENGES GmBH

ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

PACKAGE NO. 14

KAISERSLAUTERN COMMUNITY

ENERGY SAVINGS, COST ESTIMATE,
AND LIFE CYCLE COST ANALYSIS BY BUILDING
ITEM: ENERGY MONITORING AND CONTROL SYSTEM (EMCS)

TABLE EMCS-II: ONLY BUILDINGS WITH SIR 1 AND ABOVE

LEGEND FOR TABLES ON FOLLOWING PAGES

EW/KW	-	ELECTRIC DOMESTIC HW HEATER CAPACITY IN BUILDING
DR/KW	-	DRYER CAPACITY IN BUILDING
ZONE	-	NUMBER OF HEATING ZONES PER BUILDING
DP	-	DIGITAL POINT
AD	-	ANALOG POINT
HAS/MBTU	-	HEATING ANNUAL SAVINGS
EAS/MBTU	-	ELECTRICAL ANNUAL SAVINGS
IDCC/$	-	INSTRUMENTS - DIGITAL CONSTRUCTION COSTS
IACC/$	-	INSTRUMENTS - ANALOG CONSTRUCTION COSTS
MCC/$	-	MUX CONSTRUCTION COSTS
TCC/$	-	TOTAL CONSTRUCTION COSTS
IC/$	-	INVESTMENT COSTS
RCS/$	-	RECURRING SAVINGS
NRC/$	-	NON RECURRING COSTS
NDS/$	-	NET DISCOUNTED SAVINGS
SIR	-	SAVINGS RATIO

L.A.DALY HANS DOENGES GmBH

EEAP PACKAGE 14, KAISERSLAUTERN, GY 293 ARMY DEPOT
EMCS POINT COUNT, SAVINGS, COSTS AND LIFE CYCLE COST ANALYSIS BY BUILDING

TABLE: EMCS-II

BLDG.	EW/KW	OR/KW	ZONES	DP	AP	MAS/MBTU	EAS/MBTU	IDCC/$	IACC/$	MCC/$	TCC/$	IC/$	RCS/$	NRC/$	NDS/$	SIR
2200	16.0	0.0	2	9	8	191	100	2325	3349	4212	10586	10718	10203	2783	32007	2.9
2213	0.0	0.0	1	9	4	150	31	2325	2199	3356	8080	8181	0	2039	14789	1.8
2219	6.0	0.0	1	9	4	144	45	2325	2199	3356	8080	8181	3826	2039	18737	2.2
2225	2.0	0.0	1	9	4	129	45	2325	2199	3356	8080	8181	1275	2039	14665	1.7
2226	12.0	0.0	1	9	4	117	41	2325	2199	3356	8080	8181	7652	2039	19617	2.3
2238	3.0	0.0	1	9	4	86	47	2325	2199	3356	8080	8181	1913	2039	11047	1.3
2239	3.0	2.0	1	9	4	132	55	2325	2199	3356	8080	8181	3189	2039	17405	2.1
2256	0.0	0.0	1	9	4	136	33	2325	2199	3356	8080	8181	0	2039	18805	2.2
2258	0.0	0.0	1	9	4	126	51	2325	2199	3356	8080	8181	0	2039	13399	1.6
2264	0.0	0.0	2	9	8	182	78	2325	3349	4212	10586	10718	0	2783	19743	1.8
2267	0.0	0.0	1	9	4	116	45	2325	2199	3356	8080	8181	0	2039	12072	1.4
2281	12.0	0.0	3	9	12	386	107	2325	5499	5068	13092	13256	7652	3527	48850	3.6
2288	12.0	0.0	1	9	4	133	60	2325	2199	3356	8080	8181	7652	2039	22231	2.7
2289	5.0	0.0	1	9	4	427	44	2325	2199	3356	8080	8181	3189	2039	46745	5.7
2293	4.0	0.0	1	9	4	65	37	2325	2199	3356	8080	8181	2551	2039	9034	1.1
2363	12.0	0.0	1	9	4	61	34	2325	2199	3356	8080	8181	7652	2039	11246	1.3
2370	0.0	0.0	3	9	12	118	94	2325	5499	5068	13092	13256	0	3527	15387	1.1
2385	12.0	0.0	1	9	4	104	63	2325	2199	3356	8080	8181	7652	2039	21508	2.6
2389	4.0	0.0	1	9	4	58	35	2325	2199	3356	8080	8181	2551	2039	8220	1.0
2393	6.0	0.0	1	9	4	149	54	2325	2199	3356	8080	8181	3826	2039	19714	2.4
2233	0.0	0.0	5	9	20	1113	139	2325	8799	6780	18104	18330	0	5015	115100	6.2
2371	0.0	0.0	4	9	16	188	156	2325	7149	5924	15598	15793	0	4271	22934	1.4
2372	12.0	0.0	4	9	16	258	104	2325	7149	5924	15598	15793	7652	4271	34970	2.2
2425	12.0	0.0	1	9	4	68	31	2325	2199	3356	8080	8181	7652	2039	14126	1.7
2433	12.0	0.0	1	9	4	203	63	2325	2199	3356	8080	8181	7652	2039	29486	3.6
TOTAL	145.0	2.0	41	225	164	4890	1602	58125	81375	97596	242096	245122	93739	62879	611937	2.4

L.A.DALY HANS DOENGES GmBH

EEAP PACKAGE 14, KAISERSLAUTERN, GY 380 KLEBER
EMCS POINT COUNT, SAVINGS, COSTS AND LIFE CYCLE COST ANALYSIS BY BUILDING

TABLE: EMCS-II

BLDG.	EW/KW	OR/KW	ZONES	DP	AP	HAS/MBTU	EAS/MBTU	IDCC/$	IACC/$	MCC/$	TCC/$	IC/$	RCS/$	NRC/$	NDS/$	SIR
3200	0.0	144.0	4	9	16	600	154	2325	7149	5924	15598	15793	91329	4271	166822	10.5
3201	0.0	10.0	1	9	4	42	49	2325	2199	3356	8080	8181	6377	2039	11881	1.4
3203	0.0	0.0	2	9	8	93	74	2325	3349	4212	10586	10718	0	2783	12119	1.1
3206	0.0	0.0	1	9	4	213	48	2325	2199	3356	8080	8181	0	2039	13939	1.7
3209	0.0	10.0	2	9	8	200	103	2325	3349	4212	10586	10718	6377	2783	21620	2.0
3210	0.0	10.0	3	9	12	200	118	2325	5499	5068	13092	13256	6377	3527	21559	1.6
3213	0.0	36.0	2	9	8	147	106	2325	3349	4212	10586	10718	22957	2783	35004	3.2
3224	18.0	0.0	2	9	8	171	94	2325	3349	4212	10586	10718	11479	2783	24418	2.2
3225	6.0	0.0	1	9	4	91	45	2325	2199	3356	8080	8181	3826	2039	14938	1.8
3227	0.0	0.0	1	9	4	128	78	2325	2199	3356	8080	8181	0	2039	17227	2.1
3235	0.0	6.0	1	9	4	117	122	2325	2199	3356	8080	8181	3826	2039	15554	1.9
3244	0.0	36.0	2	9	8	115	71	2325	3349	4212	10586	10718	22957	2783	31153	2.9
3246	0.0	18.0	2	9	8	161	85	2325	3349	4212	10586	10718	11479	2783	23316	2.1
3251	0.0	0.0	1	9	4	219	32	2325	2199	3356	8080	8181	0	2039	13483	1.6
3252	0.0	0.0	1	9	4	165	27	2325	2199	3356	8080	8181	0	2039	9307	1.1
3254	0.0	0.0	1	9	4	165	30	2325	2199	3356	8080	8181	0	2039	9963	1.2
3265	0.0	0.0	1	9	4	80	69	2325	2199	3356	8080	8181	0	2039	11059	1.3
3266	0.0	0.0	1	9	4	95	48	2325	2199	3356	8080	8181	0	2039	11744	1.4
3278	0.0	0.0	1	9	4	107	42	2325	2199	3356	8080	8181	0	2039	12355	1.5
TOTAL	24.0	270.0	30	171	120	3109	1395	44175	59931	73180	191086	183348	187484	46925	478561	2.6

L.A.DALY HANS DOENGES GmBH

EEAP PACKAGE 14, KAISERSLAUTERN, GY 455 EQUIP SUPT CTR
EMCS POINT COUNT, SAVINGS, COSTS AND LIFE CYCLE COST ANALYSIS BY BUILDING

TABLE: EMCS-II

BLDG.	EW/KW	DR/KW	ZONES	DP	AP	MAS/MBTU	EAS/MBTU	IDCC/$	IACC/$	MCC/$	TCC/$	IC/$	RCS/$	NRC/$	NDS/$	SIR
3007	12.0	0.0	1	9	4	149	31	2325	2199	3356	8080	8181	7652	2039	16555	2.0
3008	12.0	0.0	1	9	4	156	49	2325	2199	3356	8080	8181	7652	2039	18038	2.2
3010	6.0	0.0	1	9	4	114	34	2325	2199	3356	8080	8181	3826	2039	10772	1.3
3013	1.0	0.0	1	9	4	145	28	2325	2199	3356	8080	8181	638	2039	9232	1.1
3014	12.0	0.0	1	9	4	319	32	2325	2199	3356	8080	8181	7652	2039	27461	3.3
3040	24.0	0.0	1	9	4	158	45	2325	2199	3356	8080	8181	15305	2039	31636	3.8
3041	0.0	0.0	2	9	8	157	93	2325	3949	4212	10586	10716	0	2783	16252	1.7
3042	0.0	0.0	1	9	4	87	31	2325	2199	3356	8080	8181	0	2039	8401	1.0
3043	0.0	0.0	1	9	4	95	49	2325	2199	3356	8080	8181	0	2039	10151	1.2
3050	12.0	0.0	1	9	4	57	39	2325	2199	3356	8080	8181	7652	2039	13428	1.6
3055	3.0	0.0	1	9	4	108	61	2325	2199	3356	8080	8181	1913	2039	14009	1.7
3056	0.5	0.0	1	9	4	108	57	2325	2199	3356	8080	8181	319	2039	12206	1.4
3057	0.0	0.0	1	9	4	151	30	2325	2199	3356	8080	8181	0	2039	14838	1.8
3058	0.0	0.0	1	9	4	93	34	2325	2199	3356	8080	8181	0	2039	9375	1.1
3033	12.0	0.0	1	9	4	60	35	2325	2199	3356	8080	8181	7652	2039	16937	2.0
TOTAL	94.5	0.0	16	135	64	1977	657	34875	34635	51196	123706	125252	60261	31329	231391	1.8

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EEAP PACKAGE 14, KAISERSLAUTERN, GY 490 ESELSFUERTH QM FAC
EMCS POINT COUNT, SAVINGS, COSTS AND LIFE CYCLE COST ANALYSIS BY BUILDING

TABLE: EMCS-II

BLDG.	EW/KW	DR/KW	ZONES	DP	AP	HAS/MBTU	EAS/MBTU	IDCC/$	IACC/$	MCC/$	TCC/$	IC/$	RCS/$	NRC/$	NCS/$	SIR
3401	0.0	0.0	2	9	3	314	111	2325	3349	4212	10586	10718	0	2783	34950	3.2
3406	6.0	0.0	2	9	3	133	83	2325	3349	4212	10586	10718	3826	2783	18861	1.7
3408	0.0	0.0	1	9	4	161	40	2325	2199	3356	8080	8181	0	2039	19161	2.3
3413	12.0	0.0	1	9	4	89	39	2325	2199	3356	8080	8181	7652	2039	18214	2.2
3424	6.0	0.0	1	9	4	61	23	2325	2199	3356	8080	8181	3826	2039	9173	1.1
TOTAL	24.0	0.0	7	45	25	758	296	11625	14295	18492	45412	45979	15304	11683	100259	2.1

L.A.DALY HANS DOENGES GmBH

EEAP PACKAGE 14, KAISERSLAUTERN, GY 542 RHINE ORD BARRACKS
EMCS POINT COUNT, SAVINGS, COSTS AND LIFE CYCLE COST ANALYSIS BY BUILDING

TABLE: EMCS-II

BLDG.	EW/KW	DR/KW	ZONES	DP	AP	HAS/MBTU	EAS/MBTU	IDCC/$	IACC/$	MCC/$	TCC/$	IC/$	RCS/$	NRC/$	NDS/$	SIR
150	3.0	0.0	2	9	8	122	58	2325	3349	4212	10586	10718	1913	2783	16640	1.5
162	0.0	30.0	2	9	8	150	100	2325	3349	4212	10586	10718	19131	2783	39374	3.6
163	0.0	0.0	1	9	4	81	43	2325	2199	3356	8080	8181	0	2039	9321	1.2
164	0.0	0.0	2	9	8	112	84	2325	3349	4212	10586	10718	0	2783	14896	1.3
175	24.0	0.0	1	9	4	63	42	2325	2199	3356	8080	8181	15305	2039	19443	2.3
310	0.0	0.0	1	9	4	36	35	2325	2199	3356	8080	8181	0	2039	9997	1.2
611	4.0	0.0	1	9	4	23	116	2325	2199	3356	8080	8181	2551	2039	9296	1.1
630	0.0	0.0	1	9	4	69	81	2325	2199	3356	8080	8181	0	2039	10379	1.2
646	12.0	0.0	1	9	4	95	30	2325	2199	3356	8080	8181	7652	2039	13188	1.6
695	4.0	1.5	1	9	4	85	33	2325	2199	3356	8080	8181	3507	2039	13281	1.6
TOTAL	47.0	31.5	13	90	52	836	622	23250	26940	36128	98318	89421	50059	22622	156315	1.7

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EEAP PACKAGE 14, KAISERSLAUTERN, GY 565 PANZER
EMCS POINT COUNT, SAVINGS, COSTS AND LIFE CYCLE COST ANALYSIS BY BUILDING

TABLE: EMCS-II

BLDG.	EW/KW	DR/KW	ZONES	DP	AP	MAS/MBTU	EAS/MBTU	IDCC/$	IACC/$	MCC/$	TCC/$	IC/$	RCS/$	NRC/$	NDS/$	SIR
3000	2.0	0.0	1	9	4	135	38	2325	2199	3356	8080	8181	1275	2039	9755	1.1
3001	6.0	0.0	2	9	8	112	140	2325	3349	4212	10586	10718	3826	2783	15434	1.4
3002	6.0	0.0	2	9	8	102	160	2325	3349	4212	10586	10718	3826	2783	15845	1.4
3003	6.0	0.0	2	9	8	102	160	2325	3349	4212	10586	10718	3826	2783	15845	1.4
3004	6.0	0.0	2	9	8	102	160	2325	3349	4212	10586	10718	3826	2783	15845	1.4
3005	12.0	0.0	1	9	4	110	61	2325	2199	3356	8080	8181	7652	2039	15754	1.9
3029	18.0	0.0	1	9	4	155	45	2325	2199	3356	8080	8181	11479	2039	21593	2.6
TOTAL	56.0	0.0	11	63	44	818	764	16275	21993	26916	66584	67415	35710	17249	110074	1.6

L.A.DALY HANS DOENGES GmBH

EEAP PACKAGE 14, KAISERSLAUTERN, GY 680 AND 741 DAENNER
EMCS POINT COUNT, SAVINGS, COSTS AND LIFE CYCLE COST ANALYSIS BY BUILDING

TABLE: EMCS-II

BLDG.	EW/KW	DR/KW	ZONES	DP	AP	HAS/MBTU	EAS/MBTU	IDCC/$	IACC/$	MCC/$	TCC/$	IC/$	RCS/$	NRC/$	NDS/$	SIR
3150	0.0	0.0	1	9	4	31	27	2325	2199	3356	8080	8181	0	2039	8986	1.0
3100	0.0	72.0	2	9	8	151	116	2325	3349	4212	10586	10718	45914	2783	67110	6.2
3101	0.0	54.0	2	9	8	145	116	2325	3349	4212	10586	10718	34436	2783	54920	5.1
3102	0.0	54.0	2	9	8	162	116	2325	3349	4212	10586	10718	34436	2783	56938	5.3
3103	0.0	48.0	2	9	8	162	116	2325	3349	4212	10586	10718	30610	2783	53112	4.9
3104	0.0	0.0	2	9	8	119	102	2325	3349	4212	10586	10718	0	2783	16667	1.5
3106	0.0	0.0	1	9	4	81	41	2325	2199	3356	8080	8181	0	2039	9716	1.1
3107	0.0	0.0	1	9	4	75	46	2325	2199	3356	8080	8181	3826	2039	13091	1.6
3113	25.0	0.0	1	9	4	22	29	2325	2199	3356	8080	8181	15943	2039	18029	2.2
3114	21.0	0.0	1	9	4	136	29	2325	2199	3356	8080	8181	13392	2039	26657	3.2
3116	6.0	0.0	1	9	4	137	28	2325	2199	3356	8080	8181	3826	2039	17140	2.0
3117	12.0	0.0	1	9	4	147	28	2325	2199	3356	8080	8181	7652	2039	21980	2.6
TOTAL	64.0	234.0	17	108	68	1418	794	27900	34638	44552	109490	110857	190035	28188	364346	3.2

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EEAP PACKAGE 14, KAISERSLAUTERN, GY 744 PULASKI BARRACKS
EMCS POINT COUNT, SAVINGS, COSTS AND LIFE CYCLE COST ANALYSIS BY BUILDING

TABLE: EMCS-II

BLDG.	EW/KW	DR/KW	ZONES	DP	AP	HAS/MBTU	EAS/MBTU	IDCC/$	IACC/$	HCC/$	TCC/$	IC/$	RCS/$	NRC/$	NDS/$	SIR
2855	2.0	0.0	1	9	4	64	26	2325	2199	3356	8080	8181	1275	2039	8190	1.0
2869	60.0	10.0	1	9	4	58	30	2325	2199	3356	8080	8181	44639	2039	51051	6.2
2874	0.0	0.0	1	9	4	204	45	2325	2199	3356	8080	8181	0	2039	20996	2.5
2879	0.0	0.0	1	9	4	147	45	2325	2199	3356	8080	8181	0	2039	15216	1.8
2886	0.0	10.0	1	9	4	147	45	2325	2199	3356	8080	8181	6377	2039	21593	2.6
2890	0.0	10.0	1	9	4	147	45	2325	2199	3356	8080	8181	6377	2039	21593	2.6
2895	0.0	0.0	1	9	4	182	41	2325	2199	3356	8080	8181	0	2039	18556	2.2
2902	18.0	0.0	1	9	4	46	31	2325	2199	3356	8080	8181	11479	2039	15722	1.9
2915	36.0	0.0	1	9	4	10	26	2325	2199	3356	8080	8181	22957	2039	23289	2.8
2925	0.0	10.0	1	9	4	147	45	2325	2199	3356	8080	8181	6377	2039	21593	2.6
2928	0.0	10.0	1	9	4	147	45	2325	2199	3356	8080	8181	6377	2039	21593	2.6
2930	0.0	10.0	1	9	4	147	45	2325	2199	3356	8080	8181	6377	2039	21593	2.6
2933	12.0	0.0	1	9	4	48	41	2325	2199	3356	8080	8181	7652	2039	12620	1.5
TOTAL	128.0	60.0	13	117	52	1494	519	30225	28587	43628	105040	106353	119387	26507	273605	2.5

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EEAP PACKAGE 14, KAISERSLAUTERN, GY 382 LANDSTUHL
EMCS POINT COUNT, SAVINGS, COSTS AND LIFE CYCLE COST ANALYSIS BY BUILDING

TABLE: EMCS-II

BLDG.	EW/KW	DR/KW	ZONES	DP	AP	HAS/MBTU	EAS/MBTU	IDCC/$	IACC/$	MCC/$	TCC/$	IC/$	RCS/$	NRC/$	NDS/$	SIR
3702	0.0	36.0	2	9	8	196	97	2325	3349	4212	10586	10718	22957	2783	37634	3.5
3703	0.0	0.0	2	9	8	156	70	2325	3349	4212	10586	10718	0	2783	10733	1.0
3707	0.0	36.0	2	9	8	159	97	2325	3349	4212	10586	10718	22957	2783	35293	3.2
3716	0.0	36.0	2	9	8	196	97	2325	3349	4212	10586	10718	22957	2783	37634	3.5
3717	12.0	0.0	1	9	4	102	35	2325	2199	3356	8080	8181	7652	2039	13891	1.6
3720	0.0	5.0	1	9	4	72	56	2325	2199	3356	8080	8181	3189	2039	8627	1.0
3722	3.0	0.0	1	9	4	104	36	2325	2199	3356	8080	8181	1913	2039	8331	1.0
3740	12.0	0.0	1	9	4	115	42	2325	2199	3356	8080	8181	7652	2039	15079	1.8
3754	0.0	12.0	2	9	8	105	132	2325	3349	4212	10586	10718	7652	2783	18399	1.7
3756	0.0	12.0	2	9	8	105	132	2325	3349	4212	10586	10718	7652	2783	18399	1.7
3757	0.0	0.0	1	9	4	194	142	2325	2199	3356	8080	8181	0	2039	17643	2.1
3758	0.0	0.0	1	9	4	114	83	2325	2199	3356	8080	8181	0	2039	9503	1.1
3759	0.0	0.0	1	9	4	101	99	2325	2199	3356	8080	8181	0	2039	9516	1.1
3760	0.0	0.0	1	9	4	105	83	2325	2199	3356	8080	8181	0	2039	9195	1.1
3761	0.0	0.0	1	9	4	169	142	2325	2199	3356	8080	8181	0	2039	16061	1.9
3762	0.0	0.0	1	9	4	169	142	2325	2199	3356	8080	8181	0	2039	16061	1.9
3764	0.0	0.0	1	9	4	123	88	2325	2199	3356	8080	8181	0	2039	10334	1.2
3765	0.0	0.0	2	9	8	229	48	2325	3349	4212	10586	10718	0	2783	14207	1.3
3766	0.0	0.0	2	9	8	258	109	2325	3349	4212	10586	10718	0	2783	19225	1.7
3767	0.0	0.0	1	9	4	221	125	2325	2199	3356	8080	8181	0	2039	18463	2.2
3769	0.0	0.0	1	9	4	96	99	2325	2199	3356	8080	8181	0	2039	9200	1.1
3770	0.0	0.0	1	9	4	114	99	2325	2199	3356	8080	8181	0	2039	10335	1.2
3771	0.0	0.0	1	9	4	111	83	2325	2199	3356	8080	8181	0	2039	9314	1.1
3772	0.0	0.0	1	9	4	194	142	2325	2199	3356	8080	8181	0	2039	17643	2.1
3775	0.0	0.0	1	9	4	162	82	2325	2199	3356	8080	8181	0	2039	12487	1.5

L.A.DALY HANS DOENGES GmBH

EEAP PACKAGE 14, KAISERSLAUTERN, GY 382 LANDSTUHL
EMCS POINT COUNT, SAVINGS, COSTS AND LIFE CYCLE COST ANALYSIS BY BUILDING

TABLE: EMCS-II

BLDG.	EW/KW	DR/KW	ZONES	DP	AP	HAS/MBTU	EAS/MBTU	IDCC/$	IACC/$	MCC/$	TCC/$	IC/$	RCS/$	NRC/$	NDS/$	SIR
3800	12.0	0.0	1	9	4	73	41	2325	2199	3356	8080	8181	7652	2039	12370	1.5
3809	0.0	5.0	3	9	12	299	171	2325	5499	5068	13092	13256	3189	3527	27499	2.0
3810	0.0	0.0	2	9	8	166	68	2325	3349	4212	10586	10718	0	2783	11266	1.0
3812	48.0	6.0	1	9	4	46	33	2325	2199	3356	8080	8181	34436	2039	37029	4.5
3821	0.0	10.0	1	9	4	34	33	2325	2199	3356	8080	8181	6377	2039	8472	1.0
3823	10.0	0.0	1	9	4	30	38	2325	2199	3356	8080	8181	6377	2039	8219	1.0
TOTAL	97.0	158.0	42	279	163	4318	2754	72075	86319	113452	278046	281519	162612	71393	508070	1.8

3.1.6. Maintenance and Repair Projects.

Maintenance and repair projects that provide energy savings all fall below the minimum ECIP funding requirements. Modifications that would produce savings are listed in Section 3.3.

3.2. ECIP Projects Developed.

Four Life Cycle Analysis Summaries yielded ECIP projects with an SIR greater than one (1).

PROJECT	DESCRIPTION	COST	ANNUAL SAVINGS MBTU	$	SIR
A	Weatherization	6,741,355	167,701	826,642	1.61
A	Heating Systems Mod.	806,790	185,243	904,937	14.9
A	Lighting System Mod.	1,163,065	30,278	206,575	1.95
B	EMCS	1,830,428	41,520	310,925	1.9

The Life Cycle Cost Analysis Summaries and Form 1391s are included in this Section.

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Kaiserslautern REGION NO. _____ PROJECT NUMBER _____

PROJECT TITLE Weatherization FISCAL YEAR 1987

DISCRETE PORTION NAME Wall and Roof Insulation

ANALYSIS DATE 1983 ECONOMIC LIFE 15 YEARS PREPARED BY LAD

1. INVESTMENT

A.	CONSTRUCTION COST	$ 7,099,900	
B.	SIOH (at 5.5%)	$ 390,494	
C.	DESIGN COST	$ ---	
D.	ENERGY CREDIT CALC (1A+1B+1C)X.9	$ 6,741,355	
E.	SALVAGE VALUE	$	
F.	TOTAL INVESTMENT (1D-1E)		$ 6,741,355

2. ENERGY SAVINGS (+)/COST (-)
ANALYSIS DATA ANNUAL SAVINGS, UNIT COST AND DISCOUNTED SAVINGS

FUEL		COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A.	ELEC	$		$		$
B.	DIST	$ 7.32	40,660	$ 297,631	11.36	$ 3,381,088
C.	RESID	$ 6.11	50,506	$ 308,591	13.29	$ 4,101,174
D.	NG	$		$		$
E.	COAL	$ 2.88	76,535	$ 220,420	15.39	$ 3,392,263
F.	TOTAL		167,701	$ 826,642		$10,874,525

3. NON ENERGY SAVINGS (+)/COST (-)

A. ANNUAL RECURRING (+/-) $ 0
(1) DISCOUNT FACTOR (TABLE A)
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0

B. NON RECURRING SAVINGS (+)/COST (-)

ITEM	SAVINGS (+) COST (-)(1)	YEAR OF OCCURRENCE(2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS (+) COST (-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$ 0

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+)/COST (-) (3A2+3Bd4) $ 0

4. FIRST YEAR DOLLAR SAVINGS 2F2+3A+(3B1d/YEARS ECONOMIC LIFE) $ 826,642

5. TOTAL NET DISCOUNTED SAVINGS (2F3+3C) $10,874,525

6. DISCOUNTED SAVINGS RATIO (IF LESS THAN 1 PROJECT DOES NOT QUALITY)
(SIR)=(5/1F) = 1.61

7. ECIP QUALIFICATIONS TEST

A. PROJECT NON ENERGY QUALIFICATION TEST

(1) 25% MAX NON ENERGY CALC (2F3 X .33) $ 0

(2) NON ENERGY DISCOUNTED SAVINGS (3C) $ 0

(3) ENTER SMALLER OF 7.A.1 OR 7.A.2 $

ESIR = (2F3 + 7A3)/1F = 1.61

IF LESS THAN 1 PROJECT DOES NOT QUALIFY FOR ECIP

IF GREATER THAN 1 THEN PROJECT QUALIFIES FOR ECIP

AND THE "SIR" GENERATED IN 6. IS REPORTED AS THE PROJECT "SIR".

1. COMPONENT	FY 1987 MILITARY CONSTRUCTION PROJECT DATA	2 DATE
ARMY		1 MAY 1984

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
KAISERSLAUTERN COMMUNITY, FRG	ECIP-WEATHERIZATION

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
MCA/ECIP	80000		$ 9,430.

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Wall Type CAB1	SF	2,866	1.04	3.0
Wall Type MET1	SF	63,619	0.92	58.5
Wall Type CMU1	SF	19,088	1.14	21.8
Wall Type CMU2	SF	45,404	1.14	51.8
Wall Type CMU5	SF	2,672	4.00	10.7
Wall Type CONC1	SF	16,699	4.00	66.8
Roof Type 1	SF	33,458	2.66	89.0
Roof Type 2	SF	205,365	1.84	377.9
Roof Type 3	SF	139,643	1.44	201.1
Roof Type 4	SF	66,066	2.22	146.7
Roof Type 5	SF	816,810	2.66	2,127.7
Roof Type 7	SF	80,657	2.22	179.1
Roof Type 9	SF	396,455	2.22	880.1
Roof Type 11	SF	612,902	1.60	980.6
Roof Type 14	SF	5,111	1.44	7.4
Roof Type 15	SF	12,201	1.60	19.5
Roof Type 17	SF	75,411	1.44	108.6
Roof Type 18	SF	102,255	4.36	445.8
Roof Type 19	SF	24,894	1.60	39.8
Roof Type 20	SF	212,920	1.28	272.5
Roof Type 22	SF	204,321	2.22	453.6
Roof Type 25	SF	116,564	1.60	186.5
Roof Type 29	SF	139,606	2.66	371.4
SUBTOTAL				7,099.9
Contingency (5.0 Percent)				355.0
SUBTOTAL				7,454.9
Cost Growth (19.9 Percent)				1,483.5
Total Contract Cost				8,938.4
Supervision Insp. + OHead (5.5 Percent)				491.6
TOTAL REQUEST				9,430.0
Installed Equipment - Other Approp.				(0)

10. DESCRIPTION OF PROPOSED CONSTRUCTION

This project is to insulate 160,909 sq. ft. of uninsulated walls and 2,306,823 sq. ft. of poorly insulated roofs in 233 permanent buildings. Design is special to accommodate the differing existing wall conditions. Project will reduce load on the existing heating system. There is no air conditioning involved. All required utilities presently exist. The buildings are not located in a flood plain and no demolition is required. The handicapped will not be provided for since this project does not lend itself to design for the handicapped.

1. COMPONENT	FY 19 87 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		1 MAY 1984

3. INSTALLATION AND LOCATION

KAISERSLAUTERN COMMUNITY, FRG

4. PROJECT TITLE	5. PROJECT NUMBER
ECIP- WEATHERIZATION	

11. Requirement. 2,467,732 SF: Adequate: 0 Substandard: 2,467,732 SF
ECIP Project, EEAP Package 14
SIR = 1.61

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Kaiserslautern, FRG REGION NO. _____ PROJECT NUMBER _____

PROJECT TITLE Heating Systems FISCAL YEAR 1987

DISCRETE PORTION NAME Modifications

ANALYSIS DATE 1983 ECONOMIC LIFE 15 YEARS PREPARED BY LAD

1. INVESTMENT

A.	CONSTRUCTION COST	$ 849,700	
B.	SIOH (at 5.5%)	$ 46,733	
C.	DESIGN COST	$ ---	
D.	ENERGY CREDIT CALC (1A+1B+1C)X.9	$ 806,790	
E.	SALVAGE VALUE	$ ---	
F.	TOTAL INVESTMENT (1D-1E)		$ 806,790

2. ENERGY SAVINGS (+)/COST (-)
ANALYSIS DATA ANNUAL SAVINGS, UNIT COST AND DISCOUNTED SAVINGS

FUEL		COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A.	ELEC	$		$		$
B.	DIST	$ 7.32	35,434	$ 259,377	11.36	$ 2,946,523
C.	RESID	$ 6.11	66,288	$ 405,020	13.29	$ 5,382,716
D.	NG	$		$		$
E.	COAL	$ 2.88	83,521	$ 240,540	15.39	$ 3,701,910
F.	TOTAL		185,243	$ 904,937		$12,031,149

3. NON ENERGY SAVINGS (+)/COST (-)

A. ANNUAL RECURRING (+/-) $ 0
(1) DISCOUNT FACTOR (TABLE A)
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 0

B. NON RECURRING SAVINGS (+)/COST (-)

ITEM	SAVINGS (+) COST (-)(1)	YEAR OF OCCURRENCE(2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS (+) COST (-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$ 0

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+)/COST (-) (3A2+3Bd4) $ 0

4. FIRST YEAR DOLLAR SAVINGS 2F2+3A+(3B1d/YEARS ECONOMIC LIFE) $ 904,937

5. TOTAL NET DISCOUNTED SAVINGS (2F3+3C) $ 12,031,149

6. DISCOUNTED SAVINGS RATIO (IF LESS THAN 1 PROJECT DOES NOT QUALITY)
(SIR)=(5/1F) = 14.9

7. ECIP QUALIFICATIONS TEST

A. PROJECT NON ENERGY QUALIFICATION TEST

(1) 25% MAX NON ENERGY CALC (2F3 X .33) $ 0

(2) NON ENERGY DISCOUNTED SAVINGS (3C) $ 0

(3) ENTER SMALLER OF 7.A.1 OR 7.A.2 $

ESIR = (2F3 + 7A3)/1F = 14.9

IF LESS THAN 1 PROJECT DOES NOT QUALIFY FOR ECIP

IF GREATER THAN 1 THEN PROJECT QUALIFIES FOR ECIP

AND THE "SIR" GENERATED IN 6. IS REPORTED AS THE PROJECT "SIR".

1. COMPONENT	FY 19 87 MILITARY CONSTRUCTION PROJECT DATA	2 DATE
ARMY		1 MAY 1984

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
KAISERSLAUTERN COMMUNITY, FRG	ECIP-HEATING SYSTEM MODIFICATIONS

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
MCA/ECIP	80000		$ 1,128.5

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
Thermostatic Radiator Valves	EA	5,975	26.	155.35
Reset Controllers	EA	137	3,150.	431.55
Shop and Warehouse Reset Controllers	EA	730	360.	262.80
SUBTOTAL				849.70
Contingency (5.0 Percent)				42.5
SUBTOTAL				892.2
Cost Growth (19.9 Percent)				177.5
Total Contract Cost				1,069.7
Supervision Insp. + OHead (5.5 Percent)				58.8
TOTAL REQUEST				1,128.5
				(0)

10. DESCRIPTION OF PROPOSED CONSTRUCTION

This project includes measures to achieve better efficiency of the building heating system through the use of night and weekend setback of space temperatures and the addition of thermostatic radiator valves on radiators which are now manually controlled.

The project will reduce the load on the existing heating systems. There is no air conditioning involved. The buildings are not located in a flood plain and no demolition is required. The handicapped will not be provided for since this project does not lend itself to design for the handicapped.

1. COMPONENT	FY 1987 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		1 MAY 1984

3. INSTALLATION AND LOCATION	
KAISERSLAUTERN COMMUNITY, FRG	
4. PROJECT TITLE	**5. PROJECT NUMBER**
ECIP-HEATING SYSTEM MODIFICATIONS	

11. Requirement. ECIP Project, EEAP Package 14

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LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) E-1

LOCATION: Kaiserslautern REGION NO. _____ PROJECT NUMBER _____

PROJECT TITLE Replace Existing Fluorescent Lights FISCAL YEAR 1987

DISCRETE PORTION NAME _____

ANALYSIS DATE 1983 ECONOMIC LIFE 15 YEARS PREPARED BY LAD

1. INVESTMENT

A.	CONSTRUCTION COST	$ 809,727	
B.	SIOH (at 6.5%)	$ 52,632	
C.	DESIGN COST (at 6%)	$ 48,584	
D.	ENERGY CREDIT CALC (1A+1B+1C)X.9	$ 819,849	
E.	SALVAGE VALUE	$ ---	
F.	TOTAL INVESTMENT (1D-1E)		$ 819,849

2. ENERGY SAVINGS (+)/COST (-)
ANALYSIS DATA ANNUAL SAVINGS, UNIT COST AND DISCOUNTED SAVINGS

FUEL	COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELEC	$ 4.74	17,967	$ 85,164	11.01	$ 937,651
B. DIST	$		$		$
C. RESID	$		$		$
D. NG	$		$		$
E. COAL	$		$		$
F. TOTAL		17,967	$ 85,164		$ 937,651

3. NON ENERGY SAVINGS (+)/COST (-)

A. ANNUAL RECURRING (+/-) $ 33,342
(1) DISCOUNT FACTOR (TABLE A) 9.11
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 303,743

B. NON RECURRING SAVINGS (+)/COST (-)

ITEM	SAVINGS (+) COST (-)(1)	YEAR OF OCCURRENCE(2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS (+) COST (-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$ 0

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+)/COST (-) (3A2+3Bd4) $303,743

4. FIRST YEAR DOLLAR SAVINGS 2F2+3A+(3B1d/YEARS ECONOMIC LIFE) $ 118,506

5. TOTAL NET DISCOUNTED SAVINGS (2F3+3C) $ 1,241,394

6. DISCOUNTED SAVINGS RATIO (IF LESS THAN 1 PROJECT DOES NOT QUALITY)
(SIR)=(5/1F) = 1.5

7. ECIP QUALIFICATIONS TEST

A. PROJECT NON ENERGY QUALIFICATION TEST

(1) 25% MAX NON ENERGY CALC (2F3 X .33) $ 309,424

(2) NON ENERGY DISCOUNTED SAVINGS (3C) $ 303,743

(3) ENTER SMALLER OF 7.A.1 OR 7.A.2 $ 303,743

ESIR = (2F3 + 7A3)/1F = 1.5

IF LESS THAN 1 PROJECT DOES NOT QUALIFY FOR ECIP

IF GREATER THAN 1 THEN PROJECT QUALIFIES FOR ECIP

AND THE "SIR" GENERATED IN 6. IS REPORTED AS THE PROJECT "SIR".

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) E-2

LOCATION: Kaiserslautern REGION NO. _____ PROJECT NUMBER _____

PROJECT TITLE Replace Existing Incandescent Lighting Fixtures FISCAL YEAR 1987

DISCRETE PORTION NAME _____

ANALYSIS DATE 1983 ECONOMIC LIFE 15 YEARS PREPARED BY LAD

1. INVESTMENT

A.	CONSTRUCTION COST	$ 165,850	
B.	SIOH (at 6.5%)	$ 10,780	
C.	DESIGN COST (at 6%)	$ 9,951	
D.	ENERGY CREDIT CALC (1A+1B+1C)X.9	$ 176,630	
E.	SALVAGE VALUE	$ ---	
F.	TOTAL INVESTMENT (1D-1E)		$ 176,630

2. ENERGY SAVINGS (+)/COST (-)
ANALYSIS DATA ANNUAL SAVINGS, UNIT COST AND DISCOUNTED SAVINGS

FUEL		COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A.	ELEC	$ 4.74	5,046	$ 23,918	11.01	$ 263,337
B.	DIST	$		$		$
C.	RESID	$		$		$
D.	NG	$		$		$
E.	COAL	$		$		$
F.	TOTAL		5,046	$ 23,918		$ 263,337

3. NON ENERGY SAVINGS (+)/COST (-)

A. ANNUAL RECURRING (+/-) $ + 12,180
(1) DISCOUNT FACTOR (TABLE A) 9.11
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ +110,959

B. NON RECURRING SAVINGS (+)/COST (-)

ITEM	SAVINGS (+) COST (-)(1)	YEAR OF OCCURRENCE(2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS (+) COST (-)(4)
a. Maint	$			$ + 15,595
b.	$			$
c.	$			$
d. TOTAL	$			$ + 15,595

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+)/COST (-) (3A2+3Bd4) $126,554

4. FIRST YEAR DOLLAR SAVINGS 2F2+3A+(3B1d/YEARS ECONOMIC LIFE) $ 36,098

5. TOTAL NET DISCOUNTED SAVINGS (2F3+3C) $ 389,891

6. DISCOUNTED SAVINGS RATIO (IF LESS THAN 1 PROJECT DOES NOT QUALITY) (SIR)=(5/1F) = 1.2

7. ECIP QUALIFICATIONS TEST

   A. PROJECT NON ENERGY QUALIFICATION TEST

      (1) 25% MAX NON ENERGY CALC (2F3 X .33) $ 86,901

      (2) NON ENERGY DISCOUNTED SAVINGS (3C) $ 126,554

      (3) ENTER SMALLER OF 7.A.1 OR 7.A.2 $ 86,901

      ESIR = (2F3 + 7A3)/1F = 1.2

      IF LESS THAN 1 PROJECT DOES NOT QUALIFY FOR ECIP

      IF GREATER THAN 1 THEN PROJECT QUALIFIES FOR ECIP

      AND THE "SIR" GENERATED IN 6. IS REPORTED AS THE PROJECT "SIR".

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) E-3

LOCATION: Kaiserslautern REGION NO. _____ PROJECT NUMBER _____

PROJECT TITLE Replace Existing Mercury Vapour Lights 150 W and 250 W FISCAL YEAR 1987

DISCRETE PORTION NAME _____

ANALYSIS DATE 1983 ECONOMIC LIFE 15 YEARS PREPARED BY LAD

1. INVESTMENT

A.	CONSTRUCTION COST	$ 87,900	
B.	SIOH (at 6.5%)	$ 5,713	
C.	DESIGN COST (at 6%)	$ 5,274	
D.	ENERGY CREDIT CALC (1A+1B+1C)X.9	$ 88,998	
E.	SALVAGE VALUE	$ ---	
F.	TOTAL INVESTMENT (1D-1E)		$ 88,998

2. ENERGY SAVINGS (+)/COST (-)
ANALYSIS DATA ANNUAL SAVINGS, UNIT COST AND DISCOUNTED SAVINGS

FUEL		COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A.	ELEC	$ 4.74	3,045	$ 14,433	11.01	$ 158,910
B.	DIST	$		$		$
C.	RESID	$		$		$
D.	NG	$		$		$
E.	COAL	$		$		$
F.	TOTAL		3,045	$ 14,433		$ 158,910

3. NON ENERGY SAVINGS (+)/COST (-)

A. ANNUAL RECURRING (+/-) $ 7,350
(1) DISCOUNT FACTOR (TABLE A) 9.11
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 66,958

B. NON RECURRING SAVINGS (+)/COST (-)

ITEM	SAVINGS (+) COST (-)(1)	YEAR OF OCCURRENCE(2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS (+) COST (-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+)/COST (-) (3A2+3Bd4) $ 66,958

4. FIRST YEAR DOLLAR SAVINGS 2F2+3A+(3B1d/YEARS ECONOMIC LIFE) $ 21,783

5. TOTAL NET DISCOUNTED SAVINGS (2F3+3C) $ 389,891

6. DISCOUNTED SAVINGS RATIO (IF LESS THAN 1 PROJECT DOES NOT QUALITY)
(SIR)=(5/1F) = 2.37

7. ECIP QUALIFICATIONS TEST

A. PROJECT NON ENERGY QUALIFICATION TEST

(1) 25% MAX NON ENERGY CALC (2F3 X .33) $ 52,437

(2) NON ENERGY DISCOUNTED SAVINGS (3C) $ 66,958

(3) ENTER SMALLER OF 7.A.1 OR 7.A.2 $ 52,437

ESIR = (2F3 + 7A3)/1F = 2.37

IF LESS THAN 1 PROJECT DOES NOT QUALIFY FOR ECIP

IF GREATER THAN 1 THEN PROJECT QUALIFIES FOR ECIP

AND THE "SIR" GENERATED IN 6. IS REPORTED AS THE PROJECT "SIR".

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) E-4

LOCATION: Kaiserslautern REGION NO. _____ PROJECT NUMBER _____

PROJECT TITLE Replace Existing Mercury Vapour Lights 125 W and 400 W FISCAL YEAR 1987

DISCRETE PORTION NAME _____

ANALYSIS DATE 1983 ECONOMIC LIFE 15 YEARS PREPARED BY LAD

1. INVESTMENT

A.	CONSTRUCTION COST	$ 76,630	
B.	SIOH (at 6.5%)	$ 4,981	
C.	DESIGN COST (at 6%)	$ 4,598	
D.	ENERGY CREDIT CALC (1A+1B+1C)X.9	$ 77,588	
E.	SALVAGE VALUE	$ ---	
F.	TOTAL INVESTMENT (1D-1E)		$ 77,588

2. ENERGY SAVINGS (+)/COST (-)
ANALYSIS DATA ANNUAL SAVINGS, UNIT COST AND DISCOUNTED SAVINGS

FUEL		COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A.	ELEC	$ 4.74	4,220	$ 20,003	11.01	$ 220,231
B.	DIST	$		$		$
C.	RESID	$		$		$
D.	NG	$		$		$
E.	COAL	$		$		$
F.	TOTAL		4,220	$ 20,003		$ 220,231

3. NON ENERGY SAVINGS (+)/COST (-)

A. ANNUAL RECURRING (+/-) $ 10,185
(1) DISCOUNT FACTOR (TABLE A) 9.11
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 92,785

B. NON RECURRING SAVINGS (+)/COST (-)

ITEM	SAVINGS (+) COST (-)(1)	YEAR OF OCCURRENCE(2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS (+) COST (-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+)/COST (-) (3A2+3Bd4) $ 92,785

4. FIRST YEAR DOLLAR SAVINGS 2F2+3A+(3B1d/YEARS ECONOMIC LIFE) $ 30,188

5. TOTAL NET DISCOUNTED SAVINGS (2F3+3C) $ 313,016

6. DISCOUNTED SAVINGS RATIO (IF LESS THAN 1 PROJECT DOES NOT QUALITY)
(SIR)=(5/1F) = 3.78

7. ECIP QUALIFICATIONS TEST

A. PROJECT NON ENERGY QUALIFICATION TEST

(1) 25% MAX NON ENERGY CALC (2F3 X .33) $ 72,676

(2) NON ENERGY DISCOUNTED SAVINGS (3C) $ 92,785

(3) ENTER SMALLER OF 7.A.1 OR 7.A.2 $ 72,676

ESIR = (2F3 + 7A3)/1F = 3.78

IF LESS THAN 1 PROJECT DOES NOT QUALIFY FOR ECIP

IF GREATER THAN 1 THEN PROJECT QUALIFIES FOR ECIP

AND THE "SIR" GENERATED IN 6. IS REPORTED AS THE PROJECT "SIR".

1. COMPONENT	FY 1987 MILITARY CONSTRUCTION PROJECT DATA	2 DATE
ARMY		1 MAY 1984

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
KAISERSLAUTERN COMMUNITY, FRG	ECIP-LIGHTING SYSTEMS MODIFICATIONS

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
MCA/ECIP	80000		$1,590.77

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
1) Replace inefficient fluorescent lamps by high efficient fluorescent lamps and electronic ballasts, Code E1s	EA	15,877	51	809.73
2) Replace incandescent lighting fixtures by high efficient fluorescent lighting fixtures, Code E2	EA	2,675	62	165.85
3) Replace existing mercury vapor lights by high pressure sodium vapor lights 150 w, Code E3	EA	1,103	79.69	87.90
4) Replace existing mercury vapor lights by high pressure sodium vapor lights 250 w, Code E4	EA	970	79	76.63
SUBTOTAL				1,140.11
Contingency (5.0 Percent)				114.01
SUBTOTAL				1,254.12
Cost Growth (19.9 Percent)				1,493.68
Total Contract Cost				97.09
Supervision Insp. + OHead (5.5 Percent)				1,590.77
TOTAL REQUEST				

10. DESCRIPTION OF PROPOSED CONSTRUCTION

Modification to the existing lighting systems would be made as follows:

Item 1. Low efficient fluorescent lamps and ballasts with a total of 50 w per unit would be replaced by low wattage high efficient lamps and electronic ballasts with a total of 35 w per unit.

Item 2. Low efficient incandescent lighting fixtures would be replaced by lighting fixtures with low wattage high efficient fluorescent lamps and electronic ballasts.

Item 3. Low efficient mercury vapor (MV) lights 125 w and 250 w would be replaced by high efficient high pressure sodium (HPS) lights 150 w. One HPS light would replace two 125 w MV or one 250 w MV light.

1. COMPONENT	FY 19 87 MILITARY CONSTRUCTION PROJECT DATA	2. DATE
ARMY		1 MAY 1984

3. INSTALLATION AND LOCATION

KAISERSLAUTERN COMMUNITY, FRG

4. PROJECT TITLE	5. PROJECT NUMBER
ECIP-LIGHTING SYSTEMS MODIFICATIONS	

Item 4. Low efficient mercury vapor (MV) lights 125 w and 400 w would be replaced by high efficient high pressure sodium (HPS) lights 250 w. One HPS light would replace four (4) 125 w MV or one 400 w MV light.

11. Requirement. This project is one of several projects, developed as a result of the EEAP study Package No. 14, which will be required in order for the Kaiserslautern Community to achieve the energy conservation goals established by Executive Order 12003 the Army Energy Plan and the Army Facilities Energy Plan.

a. These modifications will result in the following energy savings and SIR ratios:

Item 1: Energy Savings = 17,967 MBTU/a - SIR 1.5

Item 2: Energy Savings = 5,046 MBTU/a - SIR 2.21

Item 3: Energy Savings = 3,045 MBTU/a - SIR 2.54

Item 4: Energy Savings = 4,220 MBTU/a - SIR 4.03

TOTAL ENERGY SAVINGS 30,278 MBTU/a

b. These modifications will result in the following demand charges:

Item 1: 476.3 KW x $70/KW = 33,341 $/a

Item 2: 174 KW x $70/KW = 12,180 $/a

Item 3: 105 KW x $70/KW = 7,350 $/a

Item 4: 145.5 KW x $70/KW = 10,185 $/a

TOTAL DEMAND SAVINGS 63,056 $/a

c. These modifications will also result in an improvement of the illumination quality throughout the community, especially in those spaces having now incandescent lights.

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LOCATION: Kaiserslautern REGION NO. _____ PROJECT NUMBER _____

PROJECT TITLE Install EMCS FISCAL YEAR 1987

DISCRETE PORTION NAME _____

ANALYSIS DATE Nov 1983 ECONOMIC LIFE 15 YEARS PREPARED BY LAD

1. INVESTMENT

A.	CONSTRUCTION COST	$ 1,807,830	
B.	SIOH (at 6.5%)	$ 117,509	
C.	DESIGN COST (at 6%)	$ 108,470	
D.	ENERGY CREDIT CALC (1A+1B+1C)X.9	$ 1,830,428	
E.	SALVAGE VALUE	$ ---	
F.	TOTAL INVESTMENT (1D-1E)		$ 1,830,428

2. ENERGY SAVINGS (+)/COST (-)
ANALYSIS DATA ANNUAL SAVINGS, UNIT COST AND DISCOUNTED SAVINGS

FUEL		COST $/MBTU(1)	SAVINGS MBTU/YR(2)	ANNUAL $ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A.	ELEC	$ 4.74	14,696	$ 69,659	11.01	$ 766,945
B.	DIST	$ 7.32	4,478	$ 32,779	11.36	$ 372,369
C.	RESID	$ 6.11	10,066	$ 61,503	13.29	$ 817,375
D.	NG	$		$		$
E.	COAL	$ 2.88	12,286	$ 35,384	15.39	$ 544,560
F.	TOTAL		41,520	$ 199,325		$ 2,501,249

3. NON ENERGY SAVINGS (+)/COST (-)

A. ANNUAL RECURRING (+/-) $ 111,600
(1) DISCOUNT FACTOR (TABLE A) 9.11
(2) DISCOUNTED SAVING/COST (3A X 3A1) $ 1,016,676

B. NON RECURRING SAVINGS (+)/COST (-)

ITEM	SAVINGS (+) COST (-)(1)	YEAR OF OCCURRENCE(2)	DISCOUNT FACTOR(3)	DISCOUNTED SAVINGS (+) COST (-)(4)
a.	$			$
b.	$			$
c.	$			$
d. TOTAL	$			$

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+)/COST(-)(3A2+3Bd4) $ 1,016,676

4. FIRST YEAR DOLLAR SAVINGS 2F2+3A+(3B1d/YEARS ECONOMIC LIFE) $ 310,925

5. TOTAL NET DISCOUNTED SAVINGS (2F3+3C) $ 3,517,925

6. DISCOUNTED SAVINGS RATIO (IF LESS THAN 1 PROJECT DOES NOT QUALITY) (SIR)=(5/1F) = 1.9

7. ECIP QUALIFICATIONS TEST

   A. PROJECT NON ENERGY QUALIFICATION TEST

      (1) 25% MAX NON ENERGY CALC (2F3 X .33) $ 825,412

      (2) NON ENERGY DISCOUNTED SAVINGS (3C) $ 1,016,676

      (3) ENTER SMALLER OF 7.A.1 OR 7.A.2 $ 825,412

      ESIR = (2F3 + 7A3)/1F = 1.8

      IF LESS THAN 1 PROJECT DOES NOT QUALIFY FOR ECIP

      IF GREATER THAN 1 THEN PROJECT QUALIFIES FOR ECIP

      AND THE "SIR" GENERATED IN 6. IS REPORTED AS THE PROJECT "SIR".

1. COMPONENT	FY 19 87 MILITARY CONSTRUCTION PROJECT DATA	2 DATE
ARMY		1 MAY 1984

3. INSTALLATION AND LOCATION	4. PROJECT TITLE
KAISERSLAUTERN COMMUNITY, FRG	INSTALL EMCS GYs 382/298/380/455/490/542/565/680/744

5. PROGRAM ELEMENT	6. CATEGORY CODE	7. PROJECT NUMBER	8. PROJECT COST ($000)
MCA/ECIP	80000		$ 2,496.60

9. COST ESTIMATES

ITEM	U/M	QUANTITY	UNIT COST	COST ($000)
GY 382				
Install energy monitoring and control system consisting of:				
Local Instrumentation				278.05
Central System				158.06
GY 298, 380, 455, 490, 542, 565, 680, and 744				
Install energy monitoring and control system consisting of:				
Local Instrumentation				961.73
Field Interface Devices				100.54
Central System				309.45
SUBTOTAL				1,807.83
Contingency (10 Percent)				180.78
Total Lost FY 84				1,988.61
Escalation (19 Percent)				377.84
Total Cost FY 87				2,366.45
SIOH (5.5 Percent)				130.15
TOTAL REQUEST				2,496.60

10. DESCRIPTION OF PROPOSED CONSTRUCTION

New installation of an EMCS for the above listed GYs.

11. Requirement.

This is one of several projects, developed as a result of the EEAP study Package No. 14, which will be required in order for the Kaiserslautern Community to achieve the energy conservation goals established by Executive Order 12003 the Army Energy Plan and the Army Facilities Energy Plan. This installation will result in an estimated heating energy savings of 26,830 MBTU/a, equal to 2.01% and an electrical energy savings of 14,696 MBTU/a, equal to 1.09% of the annual community energy consumption. There will be also approximately $111,600 annual demand charges savings. If this project will not be approved, the savings will not be achieved, and the needless waste of energy will continue.

3.3. Other Energy Conservation Projects Developed

3.3.1. Maintenance and Repair Projects.

Maintenance and repair projects that would provide energy savings and fall below the minimum ECIP funding requirements are included in this Section. These projects are listed from highest to lowest SIR.

PROJECT	SEE PARA	$COST	ANNUAL SAVINGS MBTU	US$	SIR
Boiler Plant No. 3403	3.3.1.1.4.	3,224	137	1,046	3.87
Boiler Plant No. 3054	3.3.1.1.3.	3,224	90.35	689	2.40
Heat Recovery Building No. 3266	3.3.1.2.	6,474	113	1,180	1.5
Boiler Plant No. 2211	3.3.1.1.1.	34,500	1,108	5,252	1.28
Boiler Plant No. 3777	3.3.1.1.2.	129,000	2,377	9,771	1.06
TOTAL		176,422	3,825.35	17,866	

3.3.1.1. Boiler Plants.

Most of the central boiler plant projects are already programmed by DEH. See Section 3.1.2. There are, however, same further improvements that are some additional improvements that are within Community funding authority.

3.3.1.1.1. Boiler Plant No. 2211, GY 298 Army Depot.

3.3.1.1.1.1. Existing Conditions.

Boilers:

Type:	HPHW 190° C./12 bar, fire tube.
Quantity/Capacity:	2 Each 27.78 MBTU/h: 55.56 MBTU/h
Year of Construction:	1975
Type of Burners:	Rotary
Type:	HPHW 190° C./12 bar, fire tube
Quantity/Capacity:	3 each 13.09 MBTU/h: 39.27 MBTU/h

Year of Construction:	1952
Type of Burners:	Jet
Total Boiler Plant Capacity:	94.83 MBTU/h
Fuel - Type:	Oil No. 6
FY 82 Consumption:	106,111 MBTU/a

Controls.

The distribution system supply water temperature is manually controlled by ten (10) operators.

DHW Generation:

No central DHW heater existing.

Heat Distribution:

Type:	DHW piping in channels.
Condition:	Good

3.3.1.1.1.2. DEH Programmed Modifications.

The 3 each boilers 13.09 MBTU/h shall be replaced by one boiler 27.8 MBTU/h during FY 84.

3.3.1.1.1.3. Proposed Boiler Plant ECOs.

Insulate fittings above boilers are included in 7.4.

Install outdoor sensored supply water temperature controls. Energy savings (annual) by experience 1.5 percent of annual heating consumption. The annual heating consumption of the connected buildings after installation.

Install semi-conductor controls for regulating speed of supply water re-circulating pump. Based on experience, the savings are approximately 2,122 kWh/a per KW installed.

Pump capacity =	24.62 MBTU/a/KW.
Existing pump:	45 KW
Energy savings 45 KW x 24.62 MBTU/a/KW:	1,108 MBTU/a
Fuel Rate:	4.74 $/MBTU

Dollar Savings (Annual):	5,252 $	
15 Year Discount Factor:	11.01	
Discounted Savings:	57,825 $	
Construction Costs:		
Solid State Converter 45 KW =	$23,500	
Control System =	$ 4,000	
Installation =	$ 3,000	
Data Transmission System for Control Loop	$ 4,000	
		34,500 $
Non-recurring Costs:		
Maintenance 2.5 percent/a	$ 863	
Times 15 years	$12,938	
Times SPW(0.36)	$ 4,658	
Replacement after 12 years		
Limit Price $34,500 minimum		
Permanent Installation (40%)	$20,700	
Times SPW(0.44)	$ 9,108	
Total Non-recurring Costs	$13,766	
Total Net Discounted Savings	$44,059	
SIR	1.28	

3.3.1.1.2. Boiler Plant 3777, GY 382 Landshuhl Hospital.

3.3.1.1.2.1. Existing Conditions.

Boilers:

Type:	HPS 175° C./8 bar, water tube
Quantity/Capacity:	3 each 21.18 MBTU/h: 63.54 MBTU/h
Year of Construction:	1952
Type of Burners:	Travelling Grate

Total Boiler Plant Capacity:	63.54 MBTU/h
Fuel - Type:	Coal
FY 82 Consumption:	159,475 MBTU/a

Controls.

The entire boiler plant is manually operated.

DHW Generation:

No central DHW heater existing.

Heat Distribution:

Type:	HPS and condensate lines in channels
Condition:	Bad, to be renovated

3.3.1.1.2.2. DEH Programmed Modifications.

Boiler supervising system including condensate fee control is under construction. The replacement of the distribution system.

3.3.1.1.2.3. Proposed Boiler Plant ECOs.

Install automatic boiler controls for load and combustion control, combustion chamber pressure control, drum water level control. This system has to be compatible with the boiler supervising system being under construction. Savings of this system are 6% of the annual fuel consumption after implementation of building savings.

Savings:

Six (6) percent of remaining heating consumption.

of 39,623 MBTU/a:	2,377	MBTU/a
Fuel rate:	4.11	$/MBTU
Dollar Savings (Annual)	9,771	$
Discount Factor (15 year)	15.39	
Discounted Savings	150,376	$

Construction Cost:

Load and combustion controls	$23,000	
Combustion chamber pressure control	$ 9,000	
Boiler drum water level control	$11,000	
Total for One (1) Boiler	$43,000	
For Three (3) Boilers		$129,000

Non-Recurring Costs

Maintenance 2 percent/a	$ 2,580	
Over 15 years	$28,700	
SPW (0.36)	$13,932	
Total Non-Recurring Costs		$ 13,932
Net Discounted Savings		$136,444
SIR		1.06

3.3.1.1.3. Boiler Plant No. 3054, GY 455 Equipment Support Counter.

3.3.1.1.3.1. Existing Conditions:

Boilers:

Type:	HPHW 150° C./8 bar
Quantity/Capacity:	1 each 9.9 MBTU/a: 19.18 MBTU/h
Year of Construction:	1953
Type of Burners:	Jet
Total Boiler Plant Capacity:	19.18 MBTU/h
Fuel - Type:	Oil No. 6
FY 82 Consumption:	20,290 MBTU/a

Controls.

No automatic control existing.

DHW Generation:

No central DHW heater existing.

Heat Distribution:

Type:	HPHW piping in channels
Condition:	Good

3.3.1.1.3.2. DEH Programmed Modifications.

One of the two (2) boilers shall be replaced during FY 84. At the same time both boilers shall be equipped with rotary type burners.

3.3.1.1.3.3. Proposed Boiler Plant ECOs.

Install outdoor sensored supply water temperature controls. Energy savings (annual) by experience 1.5 percent of annual heating consumption. The annual heating consumption of the connected buildings after implementation of the proposed building ECIP project is 6,023 MBTU/a.

Savings:

1.5% if 6,023 MBTU/a:	90.35 MBTU/a
Fuel Rate:	7.63 $/MBTU
Dollar Savings (Annual):	689 $
Discount factor (15 years)	13.29
Discounted Savings	9,161 $

Construction Cost (See Construction Cost Estimate)

$3,150 minus $826 for valves =	
$2,324 plus large valve $900:	3,224 $

Non-Recurring Cost.

Maintenance 2.5 percent/a =	$ 80
Times 15 years =	$1,209
Times SPW (0.36) =	$ 435

Replacement after 12 years.

Limit Price $3,224 minus piping & insulation (30%):	$2,257	
Times SPW (0.44)	$ 993	
Total Non-Recurring Costs:		1,428 $
Total Net Discounted Savings:		7,733 $
SIR	2.40	

3.3.1.1.4. Boiler Plant No. 3403 GY 490 Eselsfuerth QM Fac.

3.3.1.1.4.1. Existing Conditions

Boilers:

Type:	HPS 13 bar, fire tube
Quantity/Capacity:	2 each 24.6 MBTU/h: 49.2 MBTU/h
Year of Construction:	1979/1980
Type of Burners:	Rotary
Total Boiler Plant Capacity:	49.2 MBTU/h
Fuel - Type:	Oil No. 6
FY 82 Consumption:	26,111 MBTU/a

Controls.

Load control is being performed through the rotary type burners.

DHW Generation:

Five (5) each 500 pounds DHW heaters are installed; setpoint 60° C./140° F.

Heat Distribution:

Type:	HPS/LPHW piping in channel
Condition:	Good

3.3.1.1.4.2. DEH Programmed Modifications.

No programs planned.

3.3.1.1.4.3. Proposed Boiler Plant ECOs.

Install outdoor sensored supply water temperature controls. Energy savings (annual) by experience 1.5 percent of annual heating consumption. The annual heating consumption of the connected building after implementation of the proposed building ECIP project is 9,136 MBTU/a.

Savings:

1.5% if 9,136 MBTU/a:		137 MBTU/a
Fuel Rate:		7.63 $/MBTU
Dollar Savings (Annual):		1,046 $
Discount factor (15 years)		13.29
Discounted Savings		13,896 $

Construction Cost (See Construction Cost Estimate)

$3,150 minus $826 for valves =		
$2,324 plus large valve $900:		3,224 $

Non-Recurring Cost.

Maintenance 2.5 percent/a =	$80.60	
Times 15 years =	$1,209	
Times SPW (0.36) =	$ 435	
Replacement after 12 years.		
Limit Price $3,224 minus piping and insulation (30%)	$2,257	
Times SPW (0.44)	$ 993	
Total Non-Recurring Costs:		1,428 $
Total Net Discounted Savings:		12,468 $
SIR	3.8	

3.3.1.2. Heat Recovery in HVAC Systems.

3.3.1.2.1. General.

All of the proposed heat recovery systems are run around systems because all other possible types would require extensive modifications to the existing HVAC systems. No reductions in boiler plant capacity have been calculated, since the savings are minor compared to the total capacity. Heat recovery during cooling periods have not been calculated because they are negligible. The specific savings have been calculated as following:

Cooling range: from $+18^{o}$ C. to $+3^{o}$ C. Heat Recovered (Q3):

DH = 18 kj/kg when supply air and exhaust air volumes are equal.

$$EFF = \frac{DT2}{DT\ total} = \frac{18}{20-(-12)} = \frac{18}{32} = 0.56 = 56\%$$

Q3 = 18 kj/kg = 4.29 kcal/kg = 17 BTU/kg = 17 x 1.2 = 20 BTU/m^3.

The annually recovered heat is 10 HR/day x 5 days/weeks x 52 weeks/a = 2,600 h/a.

Correction factor for operating time:

Numbers of heating days: 250 x 24 = 6,000

$$\frac{2,600}{6,000} = 0.43$$

Full load hours from VDI 2067 bVHZ = 2,030. Correction factor for other city than Düsselduof is 0.96.

bv = 2030 x 0.96 x 0.43 = 838 H/a

fa = 20 BTU/m^3 x 838

$$fa = 16,760\ \frac{BTUH}{m^3 a}$$

3.3.1.2.2. Building No. 3266 GY 380 Kleber Kaserne.

3.3.1.2.2.1. Existing Condition.

System type:

- Single zone AH-unit for secondary rooms.
- In photolabs.

System Data:

- Air Capacity:	6,700 m^3/h, fresh air rate 100%
- Heating Capacity:	452 KBTU/h
- Cooling Capacity:	%
Type of Fuel:	Oil No. 2

3.3.1.2.2.2. Programmed Modifications: None

3.3.1.2.2.3. Proposed ECO.

Install heat recovery system for above AH unit. The A/C system for TV-studio is only in operation for approximately 5 hours/week; HR-system will not be feasible.

Savings.

D.01685 MBTu/h/m^3/a x 6,700 m^3/h:	113 MBTU/a
Fuel Rate:	10.45 $/MBTU
Dollar Savings (Annual):	1,180 $
Discount Factor (15 years):	11.36
Discounted Savings:	13,405 $

Construction Costs.

Heating Coil:	703 $
Cooling Coil:	781 $
Piping, Fittings:	3,125 $
Pump:	195 $

Expansion Tank:	70 $	
Modification of Existing System:	1,000 $	
Installation, Wiring	500 $	
Total	6,474 $	6,474 $
Recurring Costs/Savings:		
Increase of electricity consumption		
Pump: 0.3 kw x 2,600 hours/a	9 MBTU/a	
Fan: 1.2 kw x 2,600 hours/a	36 MBTU/a	
Total	45 MBTU/a	(-) 45 MBTU/a
Fuel Rate:		4.74 $/MBTU
Dollar Savings(+)/Costs(-):		213 $
Discount Factor (15 years):		9.11
Discounted Savings(+)/Costs(-):		(-)1,940 $
Non-Recurring Costs:		
Maintenance 5% of 6,474 $:	324 $	
Times 15 years:	4,856 $	
Times SPW (0.36):	1,748 $	(-)1,748 $
Total Net Discounted Savings:		9,717 $
SIR		1.5

3.3.2. Non-Specific Maintenance and Repair Projects.

There are other maintenance and repair projects that provide energy savings that could not be identified by location because a complete inventory of the site is beyond the scope of this project. However, these are projects that can be identified by the community and implemented using this report to save substantial energy. The projects are as follows.

PROJECT	PARA REFERENCE
DHW Heater Insulation	3.3.2.1.
Showerhead Flow Restrictors	3.3.2.2.
Piping and Fitting Insulation	3.3.2.3.
LPS Line Insulation	3.3.2.4.
Heater Set Point Reduction	3.3.2.5.

3.3.2.1. Repair Domestic Hot Water (DHW) - Heater Insulation.

It was found during the site survey that some DHW heaters are not insulated, which results in unnecessary energy losses. Average heat loss of an uninsulated DHW-heater is approximately 1,600 BTU/h/m^2 equal to 14 MBTU/a/m^2. Construction cost is approximately 31$/$m^2$.

SIR	ELEC	COAL	OIL #2	OIL #6
Annual Energy Savings MBTU/a	14	14	14	14
Fuel Rate $/MBTU	4.74	4.11	10.45	7.63
Annual $ Savings	66.36	57.54	146.30	106.82
Discount Factor	11.01	15.39	11.36	13.29
Total Disc. Savings $	730.00	885.00	1,662.00	1,429.00
Construction Cost $	31.00	32.00	31.00	31.00
SIR	23.5	28.5	53.6	45.8

3.3.2.2. Showerhead Flow Restrictors.

Flow restriction can be added to shower heads to limit the water flow and decrease water heating requirement. The saving per showerhead can be assumed with approximately 150 m^3/a. Based on a reduced DWH-Heater temperature of 45° C. and a cold water temperature of 10° C. Heating energy is = 0.00396 MBTU/m^3/° C. This will result in annual energy savings of 150 m^3/a x (45° C.-10° C.) x 0.000396 MBTU/M^3/° C. = 20.75 MBTU/a.

SIR	ELEC	COAL	OIL #2	OIL #6
Annual Energy Savings MBTU/a	20.75	20.75	20.75	20.75
Fuel Rate $/MBTU	4.74	4.11	10.45	7.63
Annual $ Savings	98.36	85.28	216.84	158.32
Discount Factor (5 years)	4.72	5.90	4.41	5.22
Total Disc. Savings $	464.26	503.15	956.26	826.43
Construction Cost $	27.00	27.00	27.00	27.00
SIR	17.2	18.6	35.4	30.6

3.3.2.3. Improve Piping & Fitting Insulation in Mech-Rooms.

It was found during the site survey that a large number of fittings and also piping in mechanical rooms are not insulated. This results in unnecessary energy losses. Heat loss per fittings (DN80) is approximately 0.0016 MBTU/H. Full load hours/a = 9 month x 24 hours x 30 days = 6,480 hours/a. Total losses per valve = 6,480 x 0.0016 MBTU/hour = 10.37 MBTU/a. If each valve has approximately two (2) meters of non-insulated pipe, and the heat losses for an average DN80 pipe is approximately 0.00072 MBTU/H/m x 2m * 6480 = 9.33 MBTU/a. The total energy savings will be 19.7 MBTU/a per unit.

Construction Cost:

Insulation of 1.0 valve:	70$/each
Insulation 1.0 M pipe (DN80):	47$/M
Total construction cost per unit:	117$

	COAL	OIL #2	OIL #6
Energy Savings (Annual) MBTU/a	19.7	19.7	19.7
Fuel Rate $/MBTU	4.11	10.45	7.63
Dollar Savings (Annual)	80.97	205.87	150.31
Average Discount Factor (45 years)	15.39	11.36	13.29
Total Discounted Savings	1,246.00	2,339.00	1,998.00
Construction Cost	117.00	117.00	117.00
SIR	10.6	20.	17.

3.3.2.4. Insulation of Low Pressure Steam - Lines in Buildings.

It was found during site survey that many main LPS-feeder lines in the buildings basements have not been insulated, which results in unnecessary heat losses. The specific heat losses of an uninsulated LPS line (DN50) are approximately 794 BTU/h/m. The specific heat losses of an insulated LPS line (DN50) are approximately 72 BTU/h/m which results in a difference of 722 BTU/h/m equal to 9 month x 24 hours x 30 days x 722 BTU/h/m = 4.68 MBTU/a/m. Construction cost for our meter insulation is approximately 23$/m.

	COAL	OIL #6
Energy Savings (Annual) MBTU/m/a	4.68	4.68
Fuel Rate $/MBTU	4.11	7.63
Dollar Savings (Annual)	19.23	35.71
Discount Factor	15.39	13.29
Total Discounted Savings	296.00	475.00
Construction Cost $/m	23.00	23.00
SIR	12.9	20.7

3.3.2.5. Heater Set Point Reduction.

The operation of Domestic Hot Water (DHW) heaters at temperatures higher than necessary result in excess energy consumption and costs.

DHW heater setpoint should be 45° C. This will minimize energy losses from tanks on standby and will reduce the energy required to heat water to the setpoint temperature, and finally will reduce line losses. The average DHW heater setpoint was found during the site survey to be approximately 60° C. Based on the detailed calculation following the annual savings would be approximately $20,962. and the discounted savings would be $279,970. for this proposal. No construction cost shall be considered because this job can be easily performed through FE-Labor.

3.3.2.5.1. Typical DHW Heaters.

Specific losses at 60° C = 0.9* Kcal/h/°C/m^2 x 40°C = 36 kcal/h/m^2

at 45o C = -1- x 25o C = 22.5 -1-
Difference = 13.5 kcal/h/m^2
= 54 BTU /h/m^2

* 5cm insulation with K = .04 Kcal/H/°C./M on 300mm dim. vessel.
.04 x 20 x .35 * 3.44159 = .9

CAPACITY LTR.	SURFACE M^2	SPECIFIC REDUCTION BTU/H/M^2	TOTAL REDUCTION BTU/H	SPECIFIC REDUCTION BTU/H/LTR.
800	5.72	54	309	0.38
1000	7.65	54	413	0.41
1500	8.55	54	462	0.31
2000	10.37	54	560	0.28
2500	11.54	54	623	0.23

Average specific reduction = 0.32 BTU/H/Ltr.

Annual reduction: 0.32 x 24 x 365 = 2,803 BTU/LTR./a

= 0.0028 MBTU/LTR./a

3.3.2.5.2. Typical Piping System.

Sample Building: GY 380 Building No. 3246 Barr. Building.

Area: 55971 SF, four (4) floors.

Pipe Length 350m (taken from floor plan)

Specific losses at 60^{o} C = 0.3 kcal/h/^{o}C/m^2 x 40^{o} C = 12 kcal/h/m

at 45o C = ~1~ x 25o C = 7.5 ~1~
Difference = 4.5 kcal/h/m^2
= 18 BTU /h/m^2

Total: 350m x 18 BTU/h/m = 6,300 BTU/h = 0.11 BTU/h/SF
0.11 BTU/h/SF x 24 x 365 = 964 BTU/SF/a = 0.0009 MBTU/a/Sf

3.3.2.5.3. Results.

Table 3-6 lists the heating savings by DHW heater capacity and building for #2 oil, #6 oil and coal fuel. Table 3-7 lists the savings for electric DHW heaters. Table 3-8 summarizes these savings.

Table 3-6. DHW Heater Setpoint Reduction Savings for #2 Oil, #6 Oil and Coal

GY	BLDG #	SF	DHW HEATER CAP. LTR.	LINE SAVINGS MBTU/A	DHW HEATER MBTU/A	TOTAL MBTU/A
072	2615	3,598	300	3.24	0.84	4.08
	2618	1,622	120	1.46	0.34	5.88
	2619	2,289	100	2.06	0.28	2.34
					TOTAL GY	12.30
298	2256	10,147	144	9.13	0.40	9.53
	2267	15,183	300	13.66	0.84	14.50
	2276	8,094	300	7.28	0.84	8.12
	2292	12,105	500	10.90	1.40	12.30
	2293	10,170	500	9.15	1.40	10.45
	2200	37,486	500	33.74	1.40	35.14
	2225	10,770	170	9.70	0.48	10.18
	2227	3,014	100	2.71	0.28	2.99
	2233	160,603	1,560	144.54	4.37	148.91
	2363	12,366	750	11.13	2.1	13.23
	2371	118,665	2,300	106.80	6.44	113.24
	2372	113,891	2,450	102.50	6.86	109.36
	2384	5,058	370	4.55	1.03	5.58
	2385	21,344	100	19.21	0.28	19.49
	2408	7,227	980	6.50	2.74	9.24
	2411	7,227	980	6.50	2.74	9.24

Table 3-6. DHW Heater Setpoint Reduction Savings for #2 Oil, #6 Oil and Coal (continued)

GY	BLDG #	SF	DHW HEATER CAP. LTR.	LINE SAVINGS MBTU/A	DHW HEATER MBTU/A	TOTAL MBTU/A
298	2412	7,227	980	6.50	2.74	9.24
	2418	2,393	90	2.15	0.25	2.40
	2420	7,227	575	6.50	1.61	8.11
	2421	7,227	980	6.50	2.74	9.24
	2422	10,363	200	9.33	0.56	9.89
	2423	7,227	980	6.50	2.74	9.24
						-13.23
					TOTAL GY	566.39
380	3200	121,124	8,000	109.01	22.40	131.41
	3201	19,317	750	17.38	2.10	19.48
	3206	22,264	8,000	20.04	22.40	42.44
	3209	67,099	10,000	60.39	28.00	88.39
	3210	73,728	10,000	66.36	28.00	94.36
	3211	44,285	4,000	39.86	11.20	51.06
	3213	55,971	6,000	50.38	16.80	67.18
	3214	19,403	1,000	17.46	2.80	20.26
	3221	2,099	3,500	1.89	9.80	11.69
	3224	35,684	1,000	32.12	2.80	34.92
	3229	21,452	2,000	19.31	5.60	59.83
	3235	22,029	1,500	19.83	4.20	24.03
	3243	20,385	4,000	18.35	11.20	29.55
	3246	55,971	2,000	50.37	5.60	55.97
	3257	16,964	500	15.27	1.40	16.67
						-191.24
					TOTAL GY	556.00
382	3701	28,156	90	25.24	0.25	25.59
	3702	58,085	2,160	52.28	6.05	58.33
	3703	65,371	720	58.83	2.02	60.85
	3704	4,262	144	3.84	0.40	4.24
	3705	27,562	290	24.81	0.81	25.62
	3707	60,201	2,160	54.18	6.05	60.23
	3716	58,085	2,160	52.28	6.05	58.33
	3720	10,087	1,000	9.08	2.8	11.88
	3736	4,793	1,000	4.31	2.8	7.11
	3737	6,596	200	5.94	0.56	6.50
	3728	25,961	4,000	23.36	11.20	34.56
	3741	3,556	250	3.20	0.70	3.90
	3751	12,277	500	11.05	1.40	12.45
	3752	35,063	1,000	31.56	2.80	34.36
	3753	12,227	500	11.00	1.40	12.40
	3754	35,063	2,500	31.56	7.00	38.56
	3755	12,277	500	11.05	1.4	12.45
	3756	35,063	2,500	31.56	7.00	38.56
	3758	15,198	2,500	13.68	7.00	20.68
	3759	15,233	2,500	13.71	7.00	20.71
	3760	15,619	2,500	14.06	7.00	21.06
	3761	26,518	2,500	23.87	7.00	30.87
	3762	26,518	2,500	23.87	7.00	30.87
	3763	19,009	2,500	17.11	7.00	24.11
	3764	18,000	2,500	16.20	7.00	23.20

Table 3-6. DHW Heater Setpoint Reduction Savings for #2 Oil, #6 Oil and Coal (continued)

GY	BLDG #	SF	DHW HEATER CAP. LTR.	LINE SAVINGS MBTU/A	DHW HEATER MBTU/A	TOTAL MBTU/A
382	3766	35,102	2,500	31.60	7.00	38.60
	3767	32,693	2,500	29.42	7.00	36.42
	3768	26,518	2,500	23.87	7.00	30.87
	3769	14,420	2,500	12.98	7.00	19.98
	3770	15,199	2,500	13.68	7.00	20.68
	3771	14,420	2,500	12.98	7.00	19.98
	3774	15,523	1,500	13.98	4.20	18.18
	3775	31,676	1,000	28.50	2.80	31.30
	3780	11,423	1,000	10.28	2.80	13.08
	3794	9,571	3,500	8.61	9.80	18.41
	3809	72,966	11,500	65.67	32.20	97.87
	3810	51,821	1,300	46.64	3.64	50.28
	3813	13,324	940	11.99	2.63	14.62
	3815	13,324	630	11.99	1.76	13.75
	3818	9,095	780	8.19	2.18	10.37
	3819	9,095	115	8.19	0.32	8.51
	3820	13,646	2,160	12.28	6.05	18.33
	3821	13,035	290	11.73	0.81	12.54
	3823	13,035	290	11.73	0.81	12.54
	3824	14,424	630	12.98	1.76	14.74
						-18.41
					TOTAL GY	1,178.47
542	278	6,193	450	5.57	1.26	6.83
	279	6,193	150	5.57	0.42	12.82
	280	6,193	450	5.57	1.26	6.83
	281	4,659	280	4.19	0.78	4.97
	282	6,193	450	5.57	1.26	6.83
	283	6,193	450	5.57	1.26	6.83
	284	6,193	450	5.57	1.26	6.83
	289	6,505	390	5.85	1.09	6.59
	162	41,949	3,000	37.75	8.40	46.15
	270	5,380	230	4.84	0.64	5.48
	273	6,193	320	5.57	0.90	6.47
	274	6,193	450	5.57	1.26	6.83
	275	6,193	450	5.57	1.26	6.83
	695	4,595	500	4.13	1.40	5.43
						-78.66
					TOTAL GY	56.98
565	3001	48,080	1,000	43.27	2.80	46.07
	3029	30,041	1,000	27.04	2.80	29.84
					TOTAL GY	75.91
680	3103	55,014	3,000	49.57	8.40	57.91
	3106	27,550	2,000	24.80	5.60	30.40
					TOTAL GY	88.31
744	2917	6,588	200	5.93	0.56	6.49
	2918	6,588	400	5.93	1.12	7.05
	2919	6,588	400	5.93	1.12	7.05
	2921	6,588	400	5.93	1.12	7.05

Table 3-6. DHW Heater Setpoint Reduction Savings for #2 Oil, #6 Oil and Coal (continued)

GY	BLDG #	SF	DHW HEATER CAP. LTR.	LINE SAVINGS MBTU/A	DHW HEATER MBTU/A	TOTAL MBTU/A
744	2922	6,588	400	5.93	1.12	7.05
	2925	18,468	700	16.62	1.96	18.58
	2928	18,468	2,160	16.62	6.05	22.67
	2930	18,468	2,160	16.62	6.05	22.65
	2935	12,326	430	11.09	1.20	12.29
	3859	11,111	860	10.00	2.41	12.41
	2861	15,870	1,730	14.28	4.84	18.68
	2863	15,870	1,730	14.28	4.84	18.68
	2865	15,870	1,730	14.28	4.84	18.68
	2868	10,751	170	9.68	0.48	10.16
	2874	18,489	2,160	16.64	6.05	22.69
	2877	3,403	2,160	3.06	6.05	9.11
	2879	18,468	2,160	16.62	6.05	22.67
	2882	3,403	720	3.06	2.02	5.08
	2886	18,468	2,160	16.62	6.05	22.67
	2890	18,468	720	16.62	2.02	18.64
	2895	18,400	1,000	16.56	2.80	19.36
						-231.10
						78.61

Table 3-7. DWH Heater Setpoint Reduction Savings for Electricity

GY	BLDG #	SF	DHW HEATER CAP. LTR.	LINE SAVINGS MBTU/A	DHW HEATER MBTU/A	TOTAL MBTU/A
072	2281	72,226	80	65.00	0.22	65.22
	2288	9,963	80	8.97	0.22	9.19
	2289	---	15	---	---	---
	2202	---	5	---	---	---
	2219	---	20	---	---	---
	2226	13,540	90	12.19	0.25	12.44
	2238	---	5	---	---	---
	2239	---	5	---	---	---
	2324	29,322	80	26.39	0.22	26.61
	2346	---	15	---	---	---
	2363	12,366	80	11.13	0.22	11.35
	2369	118,665	240	106.80	0.67	107.47
	2372	113,891	90	102.50	0.25	102.75
	2384	---	30	---	---	---
	2385	21,344	80	19.21	0.22	19.43
	2389	---	15	---	---	---
	2425	10,202	80	9.18	0.22	9.40
	2433	28,589	80	25.73	0.22	25.95
					TOTAL GY	389.81

Table 3-7. DWH Heater Setpoint Reduction Savings for Electricity (continued)

GY	BLDG #	SF	DHW HEATER CAP. LTR.	LINE SAVINGS MBTU/A	DHW HEATER MBTU/A	TOTAL MBTU/A
382	3717	8,068	80	7.26	0.22	7.48
	3719	---	5	---	---	---
	3722	---	5	---	---	---
	3740	29,328	80	26.40	0.22	26.62
	3800	5,770	80	5.13	0.22	5.35
	3812	9,114	320	8.20	0.90	9.10
	3817	4,868	200	4.38	0.56	4.94
	3817	4,868	200	4.38	0.56	4.94
					TOTAL GY	53.49
455	3007	11,559	80	10.40	0.22	10.62
	3008	11,559	80	10.40	0.22	10.62
	3010	---	10	---	---	---
	3014	26,516	80	23.86	0.22	24.08
	3040	30,311	160	27.28	0.44	27.72
	3041	---	10	---	---	---
	3043	---	10	---	---	---
	3050	7,758	80	6.99	0.22	7.21
	3053	---	10	---	---	---
	3055	---	5	---	---	---
	3083	6,737	80	6.06	0.22	6.28
	3091	2,166	80	1.95	0.22	2.17
					TOTAL GY	88.70
490	3413	16,320	80	14.69	0.22	14.91
	3423	6,703	80	6.03	0.22	6.25
	3424	---	15	---	---	---
					TOTAL GY	21.16
542	326	---	30	---	---	---
	150	---	5	---	---	---
	175	10,280	80	9.25	0.22	9.47
	176	2,384	120	2.15	0.34	2.49
	347	---	10	---	---	---
	611	---	10	---	---	---
	622	---	10	---	---	---
	646	4,332	80	3.90	0.22	4.12
	705	---	30	---	---	---
					TOTAL GY	16.08
565	3005	34,666	80	31.20	0.22	31.42
	3019	---	30	---	---	---
	3029	30,041	100	27.04	0.28	27.32
					TOTAL GY	58.74
680	3113	5,061	90	4.55	0.25	4.80
	3114	10,659	80	9.60	0.22	9.82
	3116	---	30	---	---	---
	3117	13,695	80	12.33	0.22	12.55
	3150	12,665	80	11.40	0.22	11.62
					TOTAL GY	38.79

Table 3-7. DWH Heater Setpoint Reduction Savings for Electricity (continued)

GY	BLDG #	SF	DHW HEATER CAP. LTR.	LINE SAVINGS MBTU/A	DHW HEATER MBTU/A	TOTAL MBTU/A
744	2902	4,929	120	4.44	0.34	4.78
	2915	2,127	150	1.91	0.42	2.33
	2933	12,326	80	11.09	0.22	11.31
	2942	---	5	---	---	---
	2864	---	15	---	---	---
	2869	6,926	400	6.23	1.12	7.35
	2897	---	10	---	---	---
	2898	---	5	---	---	---
					TOTAL GY	25.77

Table 3-8. Summary of Heater DHW Setpoint Reduction Savings

GY	COAL MBTU/A	OIL #2 MBTU/A	OIL #6 MBTU/A	ELEC. MBTU/A	TOTAL
072	---	12.30	566.39	---	12.30
298	13.23	---	---	389.81	969.43
380	556.00	191.24	---	---	747.24
382	1,160.06	18.41	---	53.45	1,231.91
455	78.66	56.98	---	88.70	224.34
490	---	---	---	21.16	21.16
542	---	---	---	16.08	16.08
565	---	88.31	---	58.74	147.05
680	---	---	---	38.75	38.75
744	78.61	---	231.10	25.77	335.48
TOTAL	1,886.56	367.24	797.49	692.46	3,743.75
$/MBTU/A	4.11	10.46	7.63	4.74	---
$/A	7,753.76	3,841.33	6,084.85	3,282.26	20,962.20
DISC. F.	15.39	11.36	13.29	11.01	---
TOTAL $	119,330.00	43,634.00	80,868.00	36,138.00	279,970.00

3.3.3. Previous Energy Studies.

No previous energy studies have been performed on this facility.

3.3.4. Operational Improvements.

The maintenance and repair program seems to be inadequate and many deficiencies waste energy go unattended. The following are items that were discussed with the community:

3.3.4.1. Windows are broken for weeks and months.

3.3.4.2. Doors are bent or closing devices are broken so that the doors do not close properly.

3.3.4.3. Leaking roofs, damaging insulation where insulation does exist.

3.3.4.4. Rotting or broken wood door and window frames.

3.3.4.5. Many radiators are covered with multi-layers of paint. Result: Paint acts as insulation, higher energy usage.

3.3.4.6. Various unions are leaking. Result: Loss of condensate, continuous water and energy waste, building damages.

3.3.4.7. Many unit heaters are out of operating because the fan motors are removed or damaged. Result: Electrical space heaters or direct fired oil heaters are used to compensate lack of regular heat. Dangerous operation with direct fired oil heaters in motor repair shops.

3.3.4.8. Many showers and water taps at sinks are leaking. Result: Loss of heated water, waste of energy.

3.3.4.9. Based on the inspection labels at the boilers in buildings which are not supplied from a central heat distribution system, the last inspections took place 1977 and even earlier. Many boilers are sooted, burners are dusty. Result: Low efficiency, waste of energy.

3.3.4.10. Various radiators are completely covered with furnitures or other features, and not controllable. Some radiators have been covered by the user to reduce heat radiation, to avoid overheating of the rooms due to lack of controls. Result: Open windows, waste of energy.

3.3.4.11. Building 3114 and 3116 at Daenner Kaserne contain hand made radiators from sheet metal. We were told that one (1) of those has been blown-up already. The existing ones look like they are ready to blow-up in the near future.

3.3.4.12. Many radiators are hanging on their supply and return pipes only. Holders are not existing anymore.

3.3.4.13. Inoperative Controls.

3.3.4.13.1. Many radiator valves are stalled and cannot be adjusted. Result: Overheated rooms, open windows to compensate lack of controls, waste of energy.

3.3.4.13.2. Hand wheels are missing at many header valves. Stuffing boxes at many valves are leaking. Result: Steam leakages, energy waste.

3.3.4.13.3. Building No. 3777 Landstuhl Hospital: Combustion air controls are out of operation.

3.3.4.13.4. Building No. 3809 Landstuhl Hospital: System is very old. Firing controls partially out of operation. System operates with high water losses. Recharging two times a day for ten (10) minutes each with 1/2-inch hose.

3.3.4.13.5. Building 164 ROB: The radiators in the rooms should be equipped with thermostatic valves or should be shut-off, to avoid simultaneous heating and cooling. The filters of the A/C - units in the corridor should be cleaned.

3.3.4.13.6. Building No. 2894, Pularski Barracks: The system operates with an open firing system with four (4) each operation expansion tanks on top of building. System should be changed for closed operation to avoid corrosion. Only one of two steam/LPHW heat exchangers is equipped with primary (steam-side) safety valve. Another safety valve should be added on second heat exchanger. The system operated with heavy fuel oil. The oil is being injected with steam into the boilers. All wiring, safety switches etc. are covered with oil. A short circuit could occur soon. Burner system has to be cleaned.

3.3.4.13.7. Building No. 287 ROB: The blow-out of the safety valves enters into an outside walkway which means danger to passengers. Blow-out has to be extended to a higher point. The system has a water leakage probably in the heat exchanger. (Condensate tank flows over).

3.3.4.13.8. Building 2364 Esels-firth: The induced-draught blower is out of operation.

3.3.4.13.9. Building 3126 Daenne Kaserne: The outdoor sensor is located at south wall of building. Should be relocated to north side.

3.3.5. Previously Implemented Energy Projects.

3.3.5.1. Completed Projects.

The Kaiserslautern community has completed relatively few energy conservation measures. These have been limited to spot replacement of windows and doors, sometimes accomplished incidental to other remodeling.

3.3.5.2. Current Projects.

The community has over 200 projects in some phase of design, planning or under construction. The projects programmed for each building in the Kaserne are tabulated in the data report for the individual GY. A summary of the projects types at each Kaserne are tabulated as follows:

Current Energy Projects

PROJECT DESCRIPTION	COMMUNITY 072	298	380	382	455	490	542	565	680	744
Insulate Roof		X			X			X	X	X
Insulate Walls		X		X			X			X
Insulate Ceiling		X			X			X		X
Replace Windows		X	X	X	X	X	X	X		
Replace Windows W/Plastic Windows W/Thermopen Glazing		X			X			X	X	X

Current Energy Projects (continued)

PROJECT DESCRIPTION	COMMUNITY									
	072	298	380	382	455	490	542	565	680	744
Replace Shop Doors		X		X	X					
Replace Exterior Doors		X	X	X	X	X	X	X	X	X
Repair Windows		X								
Replace Roof		X								
Replace Walls										
Replace Low Pressure Hot Water Boiler, Oil-Fired			X				X	X		
Replace High Pressure Hot Water Boiler, Heavy Oil-Fired										
Replace Low Pressure Steam Boiler, Coal-Fired			X	X						
Replace Manual Coal-Fired Boiler W/Automatic Coal-Fired Boiler								X	X	
Replace Safety Stand Pipes W/ Safety Valves										
Install Filter System for Burning of Used POL Products		X								
Replace Hot Water Generator			X	X		X	X	X	X	
Replace Long Distance Hot Water Pipe in Channel		X		X			X	X	X	X
Replace High Pressure Hot Water Pipe in Channel		X			X		X			
Replace Condensate Pipe W/ Insulation			X	X	X	X	X	X		X
Replace Interior Heating System		X	X	X	X	X	X	X	X	X
Repair Air Conditioning System				X						
Replace Ventilation System			X		X					X
Replace Thermostatic Valves			X	X		X	X	X	X	X
Replace Thermostatic Valves and Radiators				X						
Replace Air Blowers w/Control Valves					X				X	
Convert Low Pressure Steam to Low Pressure Hot Water System				X						
Replace Insulation on Pipes and Equipment					X				X	
Replace Low Pressure Steam Boiler Oil-Fired		X	X			X				
Replace Cond. Tanks				X					X	
Replace Boilers W/Cent. Dist. System							X			
Replace Oil Burner								X		
Install Ventilation								X		
Replace H.P. HW Coal Boiler										X
Replace Interior Electrical Installation i.a.w. VDE Standards		X	X	X	X	X	X	X	X	X
Provide New Grounding System		X								
Replace Main Distribution Panels			X							
Install Emergency and Exit Lights			X							
Provide Variable Lighting Control				X						

Current Energy Projects (continued)

PROJECT DESCRIPTION	COMMUNITY 072	298	380	382	455	490	542	565	680	744
Replace Lights in Shop Area		X			X					
Relocate & Rearrange of Lighting		X		X						
Replace Low Tension Cables Exterior			X							
Replace Street Lighting System		X		X		X	X	X	X	X
Replace Fence Lighting System	X	X								
Replace Area Lighting							X			

Boiler Plant Modifications in Progress

GY	BOILER PLANT #	TYPE OF FUEL	MODIFICATION IN PROGRESS	FY	FUTURE EFFICIENCY ESTIMATED FROM FIG 6-1 & 6-2 INCLUDING DISTR. SYSTEM Capacity MBTU/H	
298	2211	#6	Three old boilers are replaced w/1975-1987 to two new boilers with a capacity (each) of 27.8 MBTU/HR. A project is under design to replace the existing three old boilers (each 77.09 MBTU/H) to one new boiler of 27.8 MBTU/HR.	1984	34.83	80
380	3244	Coal	In future, this boiler plant will only be used for stand-by since the connected buildings shall be reconnected to B.P. 3210.	1984	76.43	70
380	3210	Coal	One boiler shall be added to increase capacity for the supply of buildings being reconnected from B.P. 3244	1984	74.28	70
382	3777	Coal	Boiler supervising system is under construction, distribution system to be replaced.	1983/87	63.54	70
382	3809	Coal	Two each LPS boilers shall be replaced by LPHW boilers. Distribution system to be replaced and connected from LPS to LPHW.	1987	7.84	70
455	3054	#6	One of the two 9.9 MBTU/H boilers (1953) shall be replaced.	1984	79.84	80
490	3403	#6	No programs existing ex. boilers are of 1979/RO	---	49.2	80

Boiler Plant Modifications in Progress (continued)

GY	BOILER PLANT #	TYPE OF FUEL	MODIFICATION IN PROGRESS	FY	FUTURE EFFICIENCY ESTIMATED FROM FIG 6-1 & 6-2 INCLUDING DISTR. SYSTEM	
542	287	Coal	The existing six each boilers (1965/82) shall be replaced by three each automatic controlled boilers. The distribution system shall be partially replaced.	1987	6.80	70
542	391	Coal	No program, existing two boilers are 1976/1982	---	73.96	70
542	646	Coal	One of the three boilers (3.49 MBTU/H) shall be replaced with same capacity boiler.	1987	79.00	70
565	3001	Coal	Existing 14 boilers shall be replaced by six automatic controlled boilers. Entire distribution system shall be replaced.	1984/85	24.59	70
680	3100	#2	Complete B.P. will be converted to coal. Distribution system will be replaced.	1984/87 1987	9.23	Future Coal 70
744	2868	Coal	No B.P. modifications programmed boilers are of 1974/1979. Critical distribution lines shall be replaced.	1987	78.77	70
744	2894	#6	One of the two boilers (1952) shall be replaced, both boilers shall be equipped with rotary burners. Critical distribution lines shall be replaced.	1987	26.08	80
TOTAL					380.89	Average 74.99 Say 75

3.3.6. Future Development Plan.

The proposed ECIP projects of this study will be realized at earliest during FY 87 which means that the proposed energy savings will not start to reduce the energy consumption before FY 88. Based on this reality, the electricity consumption will increase, and the heating fuel consumption will decrease as indicated previously. In addition the following programmed increase of square footage will have to be added to the existing facilities before the ECIP projects will be completed. (Source: "Future Development Plans", prepared by John J. Harte Assoc., Inc.)

GY 298 Army Depot:	400,000 SF
GY 380 Kleber Kaserne:	41,000 SF
GY 382 Landstuhl Hospital:	200,000 SF
GY 542 Rhine Ordnance	500,000 SF
GY 565 Panzer Kaserne	3,000 SF
GY 744 Pulaski Barracks	3,000 SF
TOTAL	1,147,000 SF

All these buildings are of the type which will conserve electricity and heating energy and will increase the energy consumption. The total square footage of existing heated and illuminated buildings included in this study is approximately 6,500,000 SF. The programmed buildings will increase the energy using square footage by approximately 18 percent. Assuming that these buildings will be designed and built on the latest energy conservating standards, it can be also assumed that the energy consumption will increase not by 18 percent but by approximately 10 percent in addition to that indicated.

3.3.7. Increment 'G'.

No Increment 'G' projects were identified at this community.

3.3.8. Other Energy Conservation Opportunities Examined.

3.3.8.1. Metering.

No buildings were identified where the addition of metering might be expected to reduce energy consumption.

3.3.8.2. Solar Energy.

This region of Europe is normally overcast during much of the year. Investigation of the use of solar energy is not warranted.

3.3.8.3. District Heat.

There is no District Heating System available to the facility. The local system has no excess capacity.

3.3.8.4. Insulating Glass.

Replacement of single pane with double pane glass had an SIR less than one (1). Evaluation of each single pane window is shown in Table 3-9.

3.3.8.5. Insulation of Walls and Roofs.

Insulation of uninsulated walls and roofs is included in Increment 'A'. Walls and roofs that did not meet SIR criteria are shown in Tables 3-10 and 3-11.

Table 3-9. Savings Weatherization Glass, Kaiserslautern

BLDG	KASERNE	FUNCTION	GLASS TYPE	GLASS SQFT	SAVINGS MBTU/YEAR	SAVINGS $/YEAR	COST $	SIR	FUEL
2615	GY 072	EM BK W/MESS	SP	3598	19	2,279	3,609	.63	NO 2
2618	GY 072	OPS GEN PURP	SP	1622	3	391	866	.45	NO 2
2200	GY 298	HQ ADM BLDG	SP	37486	205	20,836	49,958	.41	NO 6
2202	GY 298	ADM GEN PURP	SP	3538	24	2,529	6,064	.41	NO 6
2213	GY 298	INFL MAT STHS	SP	10147	34	3,529	8,807	.40	NO 6
2219	GY 298	GEN PURP WHSE	SP	32262	123	12,499	31,187	.40	NO 6
2225	GY 298	CML FLD MT SH	SP	10770	75	7,672	18,914	.40	NO 6
2226	GY 298	CARE & PRES SH	SP	13540	108	10,953	27,000	.40	NO 6
2227	GY 298	GEN PURP WHSE	SP	3014	4	462	1,155	.40	NO 6
2233A	GY 298	ENG FLD MNT SH	SP	99785	3,402	344,995	850,447	.40	NO 6
2233B	GY 298	ENG FLD MNT SH	SP	60818	1,687	171,150	421,903	.40	NO 6
2238	GY 298	GEN PURP WHSE	SP	19569	74	7,580	18,914	.40	NO 6
2239	GY 298	GEN PURP WHSE	SP	29322	116	13,830	29,455	.46	NO 2
2246	GY 298	OPS GEN PURP	SP	4165	63	7,549	15,449	.48	NO 2
2257	GY 298	GEN PURP WHSE	SP	10137	11	1,157	2,887	.40	NO 6
2258	GY 298	GEN PURP WHSE	SP	29322	116	11,804	29,455	.40	NO 6
2260	GY 298	GEN PURP WHSE	SP	29322	136	16,203	34,508	.46	NO 2
2264	GY 298	GEN PURP WHSE	SP	39259	235	23,841	59,488	.40	NO 6
2267	GY 298	BOX & CRATE SH	SP	15183	107	10,894	26,856	.40	NO 6
2270	GY 298	POST RESTAURNT	SP	3442	10	1,103	2,454	.44	NO 6
2276	GY 298	ADM GEN PURP	SP	8094	59	6,022	14,438	.41	NO 6
2277	GY 298	MNT SH WHSE	SP	10070	36	3,703	9,240	.40	NO 6
2279	GY 298	ADM GEN PURP	SP	6633	22	2,288	5,486	.41	NO 6
2280	GY 298	GEN PURP WHSE	SP	11538	43	4,397	10,973	.40	NO 6
2281	GY 298	GEN PURP WHSE	SP	72226	1,466	148,661	370,933	.40	NO 6
2288	GY 298	CARE &PRES SH	SP	21736	135	13,706	33,786	.40	NO 6
2289	GY 298	GEN PURP WHSE	SP	31360	167	16,955	42,305	.40	NO 6
2293	GY 298	ADM GEN PURP	SP	10170	30	3,131	7,508	.41	NO 6
2300	GY 298	GEN PURP WHSE	SP	5319	4	542	1,155	.46	NO 2
2303	GY 298	CARE & PRES SH	SP	5525	33	4,005	7,941	.50	NO 2
2306	GY 298	CARE & PRES SH	SP	10147	57	6,845	13,572	.50	NO 2
2324	GY 298	GEN PURP WHSE	SP	29322	136	16,203	34,508	.46	NO 2
2328	GY 298	GEN PURP WHSE	SP	7924	3	406	866	.46	NO 2
2329	GY 298	CARE & PRES SH	SP	11703	6	754	1,588	.47	NO 2
2346	GY 298	SALV & SURV PR	SP	3200	20	2,470	5,197	.47	NO 2
2363	GY 298	CARE & PRES SH	SP	12366	48	3,071	12,128	.25	COAL

Table 3-9. Savings Weatherization Glass, Kaiserslautern (continued)

BLDG	KASERNE	FUNCTION	GLASS TYPE	GLASS SQFT	SAVINGS MBTU/YEAR	SAVINGS $/YEAR	COST $	SIR	FUEL
2370	GY 298	GEN PURP WHSE	SP	76064	7	949	2,021	.46	NO 2
2371A	GY 298	GEN PURP WHSE	SP	59333	9	983	2,454	.40	NO 6
2371B	GY 298	GEN PURP WHSE	SP	59333	9	983	2,454	.40	NO 6
2372A	GY 298	GEN PURP WHSE	SP	56946	5	578	1,443	.40	NO 6
2372B	GY 298	GEN PURP WHSE	SP	56946	5	578	1,443	.40	NO 6
2374	GY 298	ADM GEN PURP	SP	5058	14	1,445	3,465	.41	NO 6
2384	GY 298	ADM GEN PURP	SP	5058	27	3,245	6,641	.48	NO 2
2385	GY 298	GEN PURP WHSE	SP	21344	128	15,322	32,631	.46	NO 2
2388	GY 298	GEN PURP WHSE	SP	9963	51	6,101	12,994	.46	NO 2
2389	GY 298	GEN PURP WHSE	SP	10557	82	8,332	20,791	.40	NO 6
2393	GY 298	MOTOR REP SHOP	SP	32224	139	14,116	34,797	.40	NO 6
2394	GY 298	MOTOR REP SHOP	SP	6017	68	6,970	17,182	.40	NO 6
2408	GY 298	EM BK W/O MS	SP	7227	51	5,214	9,674	.53	NO 6
2409	GY 298	ADM GEN PURP	SP	2393	19	1,927	4,620	.41	NO 6
2410	GY 298	GEN INST BLDG	SP	3006	18	1,893	4,909	.38	NO 6
2411	GY 298	EM BK W/O MS	SP	7227	51	5,214	9,674	.53	NO 6
2412	GY 298	EM BK W/O MS	SP	7227	51	5,214	9,674	.53	NO 6
2414	GY 298	SUP SVC ADM	SP	2393	13	1,324	3,176	.41	NO 6
2418	GY 298	ADM GEN PURP	SP	2393	14	1,505	3,609	.41	NO 6
2419	GY 298	SUP SVC ADM	SP	2672	20	2,047	4,909	.41	NO 6
2420	GY 298	ADM & EM BK	SP	7227	52	5,299	12,706	.41	NO 6
2421	GY 298	EM BK W/O MS	SP	7227	51	5,214	9,674	.53	NO 6
2422	GY 298	ENL PERS MESS	SP	10363	35	3,635	8,085	.44	NO 6
2423	GY 298	EM BK W/O MS	SP	7227	51	5,214	9,674	.53	NO 6
2425	GY 298	FE MNT SHOP	SP	10202	83	8,434	20,791	.40	NO 6
2426	GY 298	DISP W/O BEDS	SP	2281	18	1,920	3,898	.49	NO 6
2427	GY 298	POST RESTAURNT	SP	2395	13	1,363	3,032	.44	NO 6
2433	GY 298	AR DEL EQP MS	SP	28589	104	10,601	26,134	.40	NO 6
3183	GY 374	BAND TNG FAC	SP	6989	14	1,696	3,754	.45	NO 2
3188	GY 374	THEAT W/ STAGE	SP	15953	62	7,427	14,727	.50	NO 2
3200	GY 380	EM BK W/O MS	SP	121124	847	53,642	159,404	.33	COAL
3201	GY 380	DISP W/O BEDS	SP	19317	100	6,349	20,647	.30	COAL
3205	GY 380	ADM & LIBRARY	SP	18942	160	10,187	39,129	.26	COAL
3206	GY 380	ENL PERS MESS	SP	22264	99	6,282	22,380	.28	COAL
3208	GY 380	FIN ADM BLDG	SP	45059	285	18,082	69,450	.26	COAL
3209	GY 380	EM BK W/O MS	SP	67099	419	26,578	78,980	.33	COAL
3210	GY 380	EM BK W/O MS	SP	73728	419	26,578	78,980	.33	COAL
3213	GY 380	EM BK W/O MS	SP	55971	234	14,868	44,182	.33	COAL
3214	GY 380	ADM GEN PURP	SP	19403	67	4,247	16,315	.26	COAL
3221	GY 380	EXCH SP SUPT	SP	2099	18	1,155	4,620	.25	COAL
3222	GY 380	MOTOR REP SHOP	SP	7016	26	1,682	6,641	.25	COAL
3224	GY 380	EM SVC CLUB	SP	35684	68	4,336	15,449	.28	COAL
3225	GY 380	CLO SALES	SP	12206	72	4,617	17,182	.26	COAL
3226	GY 380	BN HQ BLDG	SP	12678	32	2,030	7,796	.26	COAL
3227	GY 380	EM BK W/O MS	SP	33985	297	18,852	56,022	.33	COAL
3228	GY 380	CO HQ BLDG	SP	2765	23	1,503	5,775	.26	COAL
3230	GY 380	COMM CENTER	SP	8830	25	3,067	6,786	.45	NO 2
3231	GY 380	BOWLING CTR	SP	30596	48	3,065	11,406	.26	COAL
3233	GY 380	GEN INST BLDG	SP	36453	144	9,135	35,086	.26	COAL
3234	GY 380	MOTOR REP SHOP	SP	5881	42	2,705	10,684	.25	COAL
3242	GY 380	EM BK W/O MS	SP	36667	186	11,807	35,086	.33	COAL
3243	GY 380	ENL PERS MESS	SP	20385	135	8,592	30,610	.28	COAL

Table 3-9. Savings Weatherization Glass, Kaiserslautern (continued)

BLDG	KASERNE	FUNCTION	GLASS TYPE	GLASS SQFT	SAVINGS MBTU/YEAR	SAVINGS $/YEAR	COST $	SIR	FUEL
3244	GY 380	EM BK W/O MS	SP	39818	186	11,807	35,086	.33	COAL
3245	GY 380	EM BK W/O MS	SP	36667	186	11,807	35,086	.33	COAL
3246	GY 380	EM BK W/O MS	SP	55971	260	16,520	49,092	.33	COAL
3247	GY 380	MOTOR REP SHOP	SP	8966	35	2,230	8,807	.25	COAL
3251	GY 380	MOTOR REP SHOP	SP	9835	30	1,937	7,652	.25	COAL
3252	GY 380	MOTOR REP SHOP	SP	13874	25	1,645	6,497	.25	COAL
3254	GY 380	MOTOR REP SHOP	SP	14419	75	4,789	18,914	.25	COAL
3255	GY 380	MOTOR REP SHOP	SP	9509	35	2,230	8,807	.25	COAL
3257	GY 380	MOTOR REP SHOP	SP	16964	196	12,432	49,092	.25	COAL
3265	GY 380	OPEN MESS	SP	19585	118	14,072	26,711	.52	NO 2
3266	GY 380	SIG ADM BLDG	SP	25178	48	5,785	11,839	.48	NO 2
3278	GY 380	MOTOR REP SHOP	SP	15888	62	7,411	15,593	.47	NO 2
3700	GY 382	HOSPITAL	SP	54476	145	9,190	29,888	.30	COAL
3701	GY 382	GENEDEV/EXCH B	SP	28156	65	4,172	17,326	.24	COAL
3702	GY 382	EM MD BK	SP	58085	165	10,446	31,043	.33	COAL
3703	GY 382	LABORATORY	SP	65371	146	9,279	30,177	.30	COAL
3704	GY 382	SENTRY STATION	SP	4262	11	1,370	3,032	.45	NO 2
3705	GY 382	EM SERV BLDG	SP	27562	63	3,998	16,604	.24	COAL
3707	GY 382	EM MD BK	SP	60201	158	10,009	29,744	.33	COAL
3716	GY 382	EW BK W/O MS	SP	58085	165	10,446	31,043	.33	COAL
3717	GY 382	STHS / AUTO SH	SP	8068				0.00	COAL
3718	GY 382	THEAT W/ STAGE	SP	11758	3	194	721	.26	COAL
3719	GY 382	GEN STOREHOUSE	SP	8002	2	144	577	.25	COAL
3720	GY 382	GYMNASIUM	SP	10087	42	2,677	9,962	.26	COAL
3722	GY 382	BOWLING CTR	SP	26568	22	1,435	5,342	.26	COAL
3723	GY 382	MOTOR REP SHOP	SP	9230	31	1,974	7,796	.25	COAL
3724	GY 382	MOTOR REP SHOP	SP	7708	28	1,791	7,075	.25	COAL
3732	GY 382	VET FAC	SP	9513	32	2,086	6,786	.30	COAL
3736	GY 382	FIRE STATION	SP	4793	28	1,823	6,786	.26	COAL
3737	GY 382	FE MNT SHOP	SP	6596	50	3,217	12,706	.25	COAL
3738	GY 382	MEDICAL LAB	SP	25961	61	3,862	12,561	.30	COAL
3740	GY 382	GEN PURP WHSE	SP	29328	110	6,972	27,866	.25	COAL
3741	GY 382	P O MAIN	SP	3556	26	1,668	6,208	.26	COAL
3753	GY 382	BOQ MIL MALE	SP	12277	80	5,101	15,160	.33	COAL
3754	GY 382	BOQ MIL FEMALE	SP	35063	221	14,042	41,728	.33	COAL
3755	GY 382	BOQ MIL MALE	SP	12277	80	5,101	15,160	.33	COAL
3756	GY 382	BOQ MIL FEMALE	SP	35063	221	14,042	41,728	.33	COAL
3757	GY 382	HOSPITAL	SP	26518	268	17,005	55,300	.30	COAL
3758	GY 382	HOSPITAL	SP	15198	153	9,723	31,621	.30	COAL
3760	GY 382	OPS GEN PURP	SP	15619	168	10,641	31,621	.33	COAL
3764	GY 382	HOSP CLINIC	SP	18000	153	9,723	31,621	.30	COAL
3766	GY 382	CLINIC / ADM	SP	35102	130	8,270	31,765	.26	COAL
3767	GY 382	HOSP CLINIC	SP	32693	268	17,005	55,300	.30	COAL
3770	GY 382	HOSPITAL	SP	15199	153	9,723	31,621	.30	COAL
3771	GY 382	MNT / CLINIC	SP	14420	134	8,497	31,621	.26	COAL
3772	GY 382	HOSPITAL	SP	26518	267	16,960	55,156	.30	COAL
3774	GY 382	EXCH CAFE/OPS	SP	15523	89	5,674	20,214	.28	COAL
3776	GY 382	LIBRARY	SP	4719	49	3,104	11,551	.26	COAL
3780	GY 382	OPN MESS OFF	SP	11423	105	6,646	23,679	.28	COAL
3792	GY 382	MED ADM BLDG	SP	12632	52	3,345	12,850	.26	COAL
3794	GY 382	OPN MESS NCO	SP	9571	50	6,009	11,406	.52	NO 2
3800	GY 382	MOTOR REP SHOP	SP	5770	67	4,241	16,749	.25	COAL

Table 3-9. Savings Weatherization Glass, Kaiserslautern (continued)

BLDG	KASERNE	FUNCTION	GLASS TYPE	GLASS SQFT	SAVINGS MBTU/YEAR	SAVINGS $/YEAR	COST $	SIR	FUEL
3809	GY 382	LAB/ADM/EM BK	SP	72966	193	12,244	36,385	.33	COAL
3810	GY 382	SCHOOL/ADM/LAB	SP	51821	232	14,743	61,220	.24	COAL
3812	GY 382	CHILD CARE CTR	SP	9114	38	2,444	9,096	.26	COAL
3813	GY 382	EM BK W/O MS	SP	13324	100	6,365	18,914	.33	COAL
3815	GY 382	EM BK W/O MS	SP	13324	100	6,365	18,914	.33	COAL
3817	GY 382	EXCH WHSE	SP	4868	5	361	1,443	.25	COAL
3818	GY 382	BN HQ BLDG	SP	9095	42	2,706	10,395	.26	COAL
3819	GY 382	BLDGS MNT STHS	SP	9095	55	3,498	10,395	.33	COAL
3007	GY 455	MOTOR REP SHOP	SP	11559	45	2,852	11,262	.25	COAL
3008	GY 455	MOTOR REP SHOP	SP	11559	52	3,327	13,139	.25	COAL
3010	GY 455	MOTOR REP SHOP	SP	7008	43	2,778	10,973	.25	COAL
3011	GY 455	MOTOR REP SHOP	SP	7008	52	3,327	13,139	.25	COAL
3012	GY 455	MOTOR REP SHOP	SP	7008	64	4,058	16,027	.25	COAL
3013	GY 455	MOTOR REP SHOP	SP	11896	75	4,789	18,914	.25	COAL
3014	GY 455	MRS & RESTRNT	SP	26516	183	11,591	41,295	.28	COAL
3016	GY 455	VEH PAINT SHOP	SP	13543	18	1,170	4,620	.25	COAL
3020	GY 455	MOTOR REP SHOP	SP	7936	26	1,682	6,641	.25	COAL
3021	GY 455	MOTOR REP SHOP	SP	15650	30	3,637	7,652	.47	NO 2
3030	GY 455	MOTOR REP SHOP	SP	10199	57	3,656	14,438	.25	COAL
3040	GY 455	MTL & WDWK SH	SP	30311	149	15,111	37,252	.40	NO 6
3041	GY 455	MOTOR REP SHOP	SP	36102	148	15,053	37,107	.40	NO 6
3042	GY 455	MOTOR REP SHOP	SP	11445	40	4,100	10,107	.40	NO 6
3043	GY 455	MOTOR REP SHOP	SP	10438	109	11,070	27,289	.40	NO 6
3050	GY 455	MOTOR REP SHOP	SP	7758	66	6,735	16,604	.40	NO 6
3051	GY 455	MOTOR REP SHOP	SP	7762	66	6,735	16,604	.40	NO 6
3053	GY 455	ORD ADM BLDG	SP	5146	29	3,011	7,219	.41	NO 6
3055	GY 455	GEN PURP WHSE	SP	29996	120	12,267	30,610	.40	NO 6
3056	GY 455	GEN PURP WHSE	SP	29996	120	12,267	30,610	.40	NO 6
3057	GY 455	ELEC MNT SHOP	SP	19375	44	4,510	11,117	.40	NO 6
3058	GY 455	PO BRANCH	SP	17988	34	3,480	8,085	.43	NO 6
3083	GY 455	RECR BLDG	SP	6737	50	6,044	11,984	.50	NO 2
3091	GY 455	GEN MNT SHOP	SP	2166	7	892	1,877	.47	NO 2
3401	GY 490	QM REPAIR SHOP	SP	35467	248	25,245	62,231	.40	NO 6
3402	GY 490	GEN PURP WHSE	SP	18502	11	1,157	2,887	.40	NO 6
3403	GY 490	FIXED LAUNDRY	SP	40631	343	34,869	81,001	.43	NO 6
3406	GY 490	GEN PURP WHSE	SP	61637	170	17,302	43,172	.40	NO 6
3413	GY 490	SUP SVC ADM	SP	16320	74	8,819	18,048	.48	NO 2
3416	GY 490	GEN PURP WHSE	SP	12163	52	6,237	13,283	.46	NO 2
3424	GY 490	QM REPAIR SHOP	SP	4425	5	585	1,443	.40	NO 6
110	GY 542	POST RESTAURNT	SP	3850	16	1,901	3,609	.52	NO 2
150	GY 542	GEN PURP WHSE	SP	41667	144	17,220	36,674	.46	NO 2
162	GY 542	EM BK / BN HQ	SP	41949	405	48,149	76,237	.63	NO 2
163	GY 542	ENL PERS MESS	SP	9296	40	4,868	9,240	.52	NO 2
164	GY 542	ADM BLDG (A F)	SP	41949	286	34,077	69,739	.48	NO 2
175	GY 542	MOTOR REP SHOP	SP	10280	36	4,392	9,240	.47	NO 2
176	GY 542	EXCH CAFE	SP	2384	33	2,137	6,353	.33	COAL
179	GY 542	GP HQ BLDG	SP	21256	111	13,264	27,145	.48	NO 2
270	GY 542	OPS GEN PURP	SP	5380	17	2,088	4,620	.45	NO 2
273	GY 542	EM BK W/O MS	SP	6193	46	2,963	8,807	.33	COAL
274	GY 542	EM BK W/O MS	SP	6193	46	2,963	8,807	.33	COAL
275	GY 542	EMM BK W/O MS	SP	6193	46	2,963	8,807	.33	COAL
276	GY 542	CO HQ BLDG	SP	4659	27	1,766	6,786	.26	COAL

Table 3-9. Savings Weatherization Glass, Kaiserslautern (continued)

BLDG	KASERNE	FUNCTION	GLASS TYPE	GLASS SQFT	SAVINGS MBTU/YEAR	SAVINGS $/YEAR	COST $	SIR	FUEL
277	GY 542	CO HQ BLDG	SP	4659	27	1,766	6,786	.26	COAL
278	GY 542	EM BK W/O MS	SP	6193	46	2,963	8,807	.33	COAL
279	GY 542	EM BK W/O MS	SP	6193	46	2,963	8,807	.33	COAL
280	GY 542	E BK W/O MS	SP	6193	46	2,963	8,807	.33	COAL
281	GY 542	CO HQ BLDG	SP	4659	27	1,766	6,786	.26	COAL
282	GY 542	EM BK W/O MS	SP	6193	46	2,963	8,807	.33	COAL
283	GY 542	EM BK W/O MS	SP	6193	46	2,963	8,807	.33	COAL
284	GY 542	EM BK W/O MS	SP	6193	46	2,963	8,807	.33	COAL
285	GY 542	GEN INST BLDG	SP	3400	39	2,468	10,251	.24	COAL
286	GY 542	ADM GEN PURP	SP	3400	42	2,669	10,251	.26	COAL
288	GY 542	ADM GEN PURP	SP	3035	19	1,202	4,620	.26	COAL
289	GY 542	EM BK W/O MS	SP	6505	59	3,741	11,117	.33	COAL
290	GY 542	MNT SHOP	SP	2110	13	840	3,320	.25	COAL
291	GY 542	GEN STOREHOUSE	SP	5800	53	6,372	13,572	.46	NO 2
292	GY 542	CO HQ BLDG	SP	3943	20	1,278	4,909	.26	COAL
310	GY 542	MOTOR REP SHOP	SP	4323	13	1,647	3,465	.47	NO 2
337	GY 542	ADM GEN PURP	SP	3875	4	564	1,155	.48	NO 2
344	GY 542	GEN STOREHOUSE	SP	3875		67	144	.46	NO 2
347	GY 542	SM ARMS REP SH	SP	4197	1	137	288	.47	NO 2
369	GY 542	MOTOR REP SHOP	SP	3400	11	1,372	2,887	.47	NO 2
370	GY 542	MOTOR REP SHOP	SP	3400	11	1,372	2,887	.47	NO 2
371	GY 542	MOTOR REP SHOP	SP	3400	11	1,372	2,887	.47	NO 2
372	GY 542	MTL & WDWK SH	SP	3400	11	1,372	2,887	.47	NO 2
394	GY 542	MOTOR REP SHOP	SP	10543	9	1,097	2,310	.47	NO 2
395	GY 542	MOTOR REP SHOP	SP	10543	9	1,097	2,310	.47	NO 2
611	GY 542	MSL ASY & TEST	SP	21736	2	274	577	.47	NO 2
622	GY 542	MOTOR REP SHOP	SP	3228	15	1,784	3,754	.47	NO 2
630	GY 542	AMMO RENV SHOP	SP	13803	56	6,721	14,872	.45	NO 2
637	GY 542	WTNG SHELTER	SP	5046	20	2,479	5,486	.45	NO 2
646	GY 542	MOTOR REP SHOP	SP	4332	19	1,243	4,909	.25	COAL
695	GY 542	CHEMISTRY LAB	SP	4595	57	6,845	13,572	.50	NO 2
701	GY 542	AMMO RENV SHOP	SP	3388	7	892	1,877	.47	NO 2
3000	GY 565	WAREHOUSE	SP	11340	73	4,623	18,481	.25	COAL
3006	GY 565	MOTOR REPAIR	SP	4965	32	2,084	8,230	.25	COAL
3009	GY 565	MOTOR REPAIR	SP	3872	32	2,084	8,230	.25	COAL
3019	GY 565	ADM GEN PURP	SP	2815	29	1,879	7,219	.26	COAL
3029	GY 565	QM REPAIR SHOP	SP	30041	106	12,627	26,567	.47	NO 2
3100	GY 680	EM BK W/O MS	SP	57645	267	31,826	50,391	.63	NO 2
3101	GY 680	ADM & SUP / BK	SP	55014	244	29,090	46,059	.63	NO 2
3102	GY 680	EM BK W/O MS	SP	55014	244	29,090	46,059	.63	NO 2
3103	GY 680	EM BK W/O MS	SP	55014	244	29,090	46,059	.63	NO 2
3106	GY 680	ENL PERS MESS	SP	27550	99	11,866	22,524	.52	NO 2
3107	GY 680	ADM GEN PURP	SP	27550	92	11,006	22,524	.48	NO 2
3113	GY 680	FE FAC	SP	5061	15	1,834	3,754	.48	NO 2
3114	GY 680	MOTOR REP SHOP	SP	10659	136	13,881	34,220	.40	NO 6
3115	GY 680	SKILL DEV GEN	SP	3170	12	1,288	3,176	.40	NO 6
3116	GY 680	MOTOR REP SHOP	SP	10842	136	13,881	34,220	.40	NO 6
3117	GY 680	MOTOR REP SHOP	SP	13695	91	9,313	22,957	.40	NO 6
3150	GY 741	POST CHAPEL	SP	12665	53	6,408	12,706	.50	NO 2
2850	GY 744	GEN PURP WHSE	SP	2135	2	271	577	.46	NO 2
2855	GY 744	MOTOR REP SHOP	SP	2618	10	1,235	2,598	.47	NO 2
2859	GY 744	MOTOR REP SHOP	SP	11111	60	3,839	15,160	.25	COAL

Table 3-9. Savings Weatherization Glass, Kaiserslautern (continued)

BLDG	KASERNE	FUNCTION	GLASS TYPE	GLASS SQFT	SAVINGS MBTU/YEAR	SAVINGS $/YEAR	COST $	SIR	FUEL
2862	GY 744	CO HQ BLDG	SP	3943	16	1,052	4,042	.26	COAL
2864	GY 744	POST RESTAURNT	SP	3943	17	1,134	4,042	.28	COAL
2866	GY 744	CO HQ BLDG	SP	3943	16	1,052	4,042	.26	COAL
2867	GY 744	EM BK W/O MS	SP	10585	21	1,360	4,042	.33	COAL
2869	GY 744	MORGUE	SP	6926	55	6,582	11,406	.57	NO 2
2872	GY 744	GEN PURP WHSE	SP	3622	30	3,066	7,652	.40	NO 6
2874	GY 744	EM BK W/O MS	SP	18489	141	14,321	26,567	.53	NO 6
2876	GY 744	CO HQ BLDG	SP	4659	24	2,529	6,064	.41	NO 6
2877	GY 744	GEN STOREHOUSE	SP	3403	37	3,819	9,529	.40	NO 6
2879	GY 744	EM BK W/O MS	SP	18468	141	14,321	26,567	.53	NO 6
2880	GY 744	CO HQ BLDG	SP	4659	24	2,529	6,064	.41	NO 6
2882	GY 744	RECR BLDG	SP	3403	41	4,226	9,818	.43	NO 6
2885	GY 744	UNIT CHAPEL	SP	2580	11	737	2,743	.26	COAL
2886	GY 744	EM BK W/O MS	SP	18468	141	14,321	26,567	.53	NO 6
2887	GY 744	CO HQ BLDG	SP	4781	20	2,107	5,053	.41	NO 6
2890	GY 744	EM BK W/O MS	SP	18468	141	14,321	26,567	.53	NO 6
2891	GY 744	CO HQ BLDG	SP	4659	18	1,866	4,476	.41	NO 6
2895	GY 744	ENL PER MESS	SP	18400	90	9,154	20,358	.44	NO 6
2897	GY 744	ADM GEN PURP	SP	6723	50	5,997	12,273	.48	NO 2
2898	GY 744	VET FAC	SP	2127	16	1,707	3,465	.49	NO 6
2899	GY 744	SP SVC OFF	SP	2867	27	2,796	6,497	.43	NO 6
2901	GY 744	THRIFT SHOP	SP	2127	14	1,491	3,465	.43	NO 6
2902	GY 744	MOTOR REP SHOP	SP	4929	27	2,811	6,930	.40	NO 6
2909	GY 744	GEN STOREHOUSE	SP	2180	9	925	2,310	.40	NO 6
2910	GY 744	GEN STOREHOUSE	SP	2180	8	867	2,165	.40	NO 6
2911	GY 744	GEN STOREHOUSE	SP	2180	8	867	2,165	.40	NO 6
2912	GY 744	GEN STOREHOUSE	SP	2180	8	867	2,165	.40	NO 6
2913	GY 744	CO HQ BLDG	SP	2127	14	1,445	3,465	.41	NO 6
2915	GY 744	CO HQ BLDG	SP	2127	14	1,445	3,465	.41	NO 6
2917	GY 744	DISP W/ BEDS	SP	6588	38	3,911	7,941	.49	NO 6
2918	GY 744	BOQ MIL MALE	SP	6588	42	4,281	7,941	.53	NO 6
2919	GY 744	BOQ MIL MALE	SP	6588	42	4,281	7,941	.53	NO 6
2921	GY 744	BOQ MIL MALE	SP	6588	43	4,436	8,230	.53	NO 6
2922	GY 744	BOQ MIL MALE	SP	6588	34	3,502	6,497	.53	NO 6
2923	GY 744	CO HQ BLDG	SP	4659	19	1,987	4,764	.41	NO 6
2925	GY 744	EM BK W/O MS	SP	18468	141	14,321	26,567	.53	NO 6
2926	GY 744	CO HQ BLDG	SP	4659	23	1,466	5,631	.26	COAL
2928	GY 744	EM BK W/O MS	SP	18468	141	14,321	26,567	.53	NO 6
2929	GY 744	CO HQ BLDG	SP	4659	24	2,529	6,064	.41	NO 6
2930	GY 744	EM BK W/O MS	SP	18468	141	14,321	26,567	.53	NO 6
2932	GY 744	GEN INST BLDG	SP	4659	24	2,529	6,064	.41	NO 6
2933	GY 744	ADM GEN PURP	SP	12326	67	6,864	16,460	.41	NO 6
2934	GY 744	ADM (BANK)	SP	4659	24	2,529	6,064	.41	NO 6
2935	GY 744	XMTR BLDG/ADM	SP	12326	67	6,864	16,460	.41	NO 6
2942	GY 744	MOTOR REP SHOP	SP	4231	15	1,852	3,898	.47	NO 2

TOTAL ANNUAL HEAT SAVINGS	28,719
TOTAL DOLLAR SAVINGS	2,555,908
TOTAL COST	6,546,571
TOTAL SQFT	4,900,545
TOTAL SQFT GLASS	487,858

Table 3-10. Savings Weatherization Walls, Kaiserslautern

BLDG	KASERNE	FUNCTION	WALL TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT WALL
2618	GY072	OPS GEN PUR	CMU4	1,622	138	16,451	24,867	.66	NO 2	6,486
2619	GY072	READY BLDG	CMU5	2,289	65	7,774	10,395	.74	NO 2	2,711
2200	GY298	HQ ADM BLDG	WD1	37,486				0.00	NO 6	40,091
2202	GY298	ADM GEN PUR	WD1	3,538				0.00	NO 6	4,745
2219	GY298	GEN PURP WH	CMU4	32,262	461	46,825	79,826	.58	NO 6	20,820
2225	GY298	CML FLD MT	CMU4	10,770	248	25,214	42,467	.59	NO 6	11,076
2226	GY298	CARE & PRES	CMU4	13,540	295	29,936	50,420	.59	NO 6	13,150
2233A	GY298	ENG FLD MNT	CMU4	99,785	1,734	175,917	296,285	.59	NO 6	77,278
2233B	GY298	ENG FLD MNT	CMU4	60,818	861	87,370	147,152	.59	NO 6	38,380
2238	GY298	GEN PURP WH	CMU4	19,569	280	28,438	48,481	.58	NO 6	12,645
2239	GY298	GEN PURP WH	CMU4	29,322	373	44,375	64,570	.68	NO 2	16,841
2246	GY298	OPS GEN PUR	MET2	4,165	67	7,996	9,804	.81	NO 2	4,192
2257	GY298	GEN PURP WH	MET2	10,137	122	12,443	18,601	.66	NO 6	7,953
2258	GY298	GEN PURP WH	CMU4	29,322	373	37,876	64,570	.58	NO 6	16,841
2260	GY298	GEN PURP WH	CMU4	29,322	373	44,375	64,570	.68	NO 2	16,841
2264	GY298	GEN PURP WH	CMU3	39,259	619	62,780	94,677	.66	NO 6	24,694
2270	GY298	POST RESTAU	WD1	3,442				0.00	NO 6	3,402
2276	GY298	ADM GEN PUR	WD1	8,094				0.00	NO 6	4,680
2277	GY298	MNT SH WHSE	MET2	10,070	115	11,666	17,439	.66	NO 6	7,456
2279	GY298	ADM GEN PUR	WD1	6,633				0.00	NO 6	4,047
2280	GY298	GEN PURP WH	CMU6	11,538				0.00	NO 6	8,769
2281	GY298	GEN PURP WH	MAS2	72,226	416	42,280	60,096	.70	NO 6	30,885
2288	GY298	CARE &PRES	MAS2	21,736	207	20,994	29,480	.71	NO 6	15,151
2292	GY298	EAM BLDG	MAS1	12,105	169	17,227	28,458	.60	NO 6	6,778
2293	GY298	ADM GEN PUR	CONC2	10,170	254	25,825	29,597	.87	NO 6	7,049
2303	GY298	CARE & PRES	MET2	5,525	87	10,380	12,330	.84	NO 2	5,272
2306	GY298	CARE & PRES	MET2	10,147	111	13,219	15,702	.84	NO 2	6,714
2324	GY298	GEN PURP WH	CMU4	29,322	373	44,375	64,570	.68	NO 2	16,841
2328	GY298	GEN PURP WH	MET2	7,924	106	12,622	16,105	.78	NO 2	6,886
2329	GY298	CARE & PRES	MET2	11,703	88	10,474	13,203	.79	NO 2	5,645
2346	GY298	SALV & SURV	WD1	3,200				0.00	NO 2	5,070
2363	GY298	CARE & PRES	MET4	12,366				0.00	COAL	9,735
2370	GY298	GEN PURP WH	MET5	76,064				0.00	NO 2	19,583
2371A	GY298	GEN PURP WH	MET5	59,333				0.00	NO 6	15,789
2371B	GY298	GEN PURP WH	MET5	59,333				0.00	NO 6	15,789
2372A	GY298	GEN PURP WH	MET2	56,946	370	37,573	56,167	.66	NO 6	24,016
2372B	GY298	GEN PURP WH	MET2	56,946	370	37,573	56,167	.66	NO 6	24,016
2374	GY298	ADM GEN PUR	CONC3	5,058	62	6,324	12,541	.50	NO 6	3,271
2384	GY298	ADM GEN PUR	WD1	5,058				0.00	NO 2	5,448
2385	GY298	GEN PURP WH	MET2	21,344	204	24,353	31,073	.78	NO 2	13,286
2388	GY298	GEN PURP WH	MET2	9,963	106	12,707	16,213	.78	NO 2	6,932
2389	GY298	GEN PURP WH	MAS3	10,557	168	17,044	37,128	.45	NO 6	9,684
2393	GY298	MOTOR REP S	CMU3	32,224	444	45,077	67,161	.67	NO 6	17,517
2394	GY298	MOTOR REP S	MAS3	6,017	104	10,598	22,809	.46	NO 6	5,949
2408	GY298	EM BK W/O M	WD1	7,227				0.00	NO 6	6,567
2409	GY298	ADM GEN PUR	WD1	2,393				0.00	NO 6	2,591
2410	GY298	GEN INST BL	WD1	3,006				0.00	NO 6	3,163
2411	GY298	EM BK W/O M	WD1	7,227				0.00	NO 6	6,567
2412	GY298	EM BK W/O M	WD1	7,227				0.00	NO 6	6,567
2414	GY298	SUP SVC ADM	WD1	2,393				0.00	NO 6	2,591
2418	GY298	ADM GEN PUR	WD1	2,393				0.00	NO 6	2,591
2419	GY298	SUP SVC ADM	WD1	2,672				0.00	NO 6	2,832

Table 3-10. Savings Weatherization Walls, Kaiserslautern (continued)

BLDG	KASERNE	FUNCTION	WALL TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT WALL
2420	GY298	ADM & EM BK	WD1	7,227				0.00	NO 6	6,567
2421	GY298	EM BK W/O M	WD1	7,227				0.00	NO 6	6,567
2422	GY298	ENL PERS ME	WD1	10,363				0.00	NO 6	4,850
2423	GY298	EM BK W/O M	WD1	7,227				0.00	NO 6	6,567
2425	GY298	FE MNT SHOP	MET2	10,202	110	11,164	16,488	.67	NO 6	7,049
2426	GY298	DISP W/O BE	WD1	2,281				0.00	NO 6	2,500
2427	GY298	POST RESTAU	WD1	2,395				0.00	NO 6	2,410
2433	GY298	AR DEL EQP	CMU3	28,589	470	47,680	71,039	.67	NO 6	18,528
3183	GY374	BAND TNG FA	MAS1	6,989	122	14,602	20,589	.70	NO 2	4,904
3188	GY374	THEAT W/ ST	MAS2	15,953	216	25,741	29,074	.88	NO 2	14,942
3200	GY380	EM BK W/O M	MAS4	121,124	754	47,767	113,202	.42	COAL	58,179
3201	GY380	DISP W/O BE	MAS4	19,317	90	5,755	14,927	.38	COAL	7,671
3203	GY380	ADM GEN PUR	MAS4	36,753	114	7,217	22,108	.32	COAL	11,362
3205	GY380	ADM & LIBRA	MAS4	18,942	75	4,750	14,550	.32	COAL	7,478
3206	GY380	ENL PERS ME	MAS1	22,264	235	14,922	33,879	.44	COAL	8,070
3208	GY380	FIN ADM BLD	MAS4	45,059	247	15,638	47,902	.32	COAL	24,618
3209	GY380	EM BK W/O M	MAS4	67,099	333	21,087	49,975	.42	COAL	25,684
3210	GY380	EM BK W/O M	MAS4	73,728	333	21,087	49,975	.42	COAL	25,684
3211	GY380	ADM GEN PUR	MAS4	44,285	210	13,335	40,846	.32	COAL	20,992
3212	GY380	GEN E DEV F	MAS4	21,082	111	7,087	23,469	.30	COAL	12,061
3213	GY380	EM BK W/O M	MAS4	55,971	267	16,926	40,113	.42	COAL	20,616
3214	GY380	ADM GEN PUR	MAS4	19,403	77	4,880	14,948	.32	COAL	7,682
3221	GY380	EXCH SP SUP	MAS4	2,099	24	1,563	4,982	.31	COAL	2,560
3222	GY380	MOTOR REP S	CMU4	7,016	164	10,443	28,176	.37	COAL	7,349
3224	GY380	EM SVC CLUB	MAS4	35,684	155	9,874	28,054	.35	COAL	14,418
3225	GY380	CLO SALES	MAS4	12,206	102	6,504	19,303	.33	COAL	9,920
3226	GY380	BN HQ BLDG	MAS3	12,678	75	4,761	15,965	.29	COAL	4,164
3227	GY380	EM BK W/O M	MAS4	33,985	226	14,311	33,916	.42	COAL	17,431
3228	GY380	CO HQ BLDG	MAS4	2,765	27	1,756	5,380	.32	COAL	2,765
3229	GY380	ADM GEN PUR	MAS4	21,452	92	5,864	17,963	.32	COAL	9,232
3230	GY380	COMM CENTER	MAS4	8,830	37	4,497	7,934	.56	NO 2	4,078
3231	GY380	BOWLING CTR	MAS4	30,596	149	9,481	28,138	.33	COAL	14,461
3233	GY380	GEN INST BL	MAS4	36,453	180	11,394	34,900	.32	COAL	17,936
3234	GY380	MOTOR REP S	CMU4	5,881	141	8,960	24,174	.37	COAL	6,305
3235	GY380	GYMNASIUM	MAS3	22,029	234	14,857	48,266	.30	COAL	12,589
3242	GY380	EM BK W/O M	MAS4	36,667	232	14,727	34,900	.42	COAL	17,936
3243	GY380	ENL PERS ME	MAS4	20,385	113	7,162	20,350	.35	COAL	10,458
3244	GY380	EM BK W/O M	MAS4	39,818	232	14,727	34,900	.42	COAL	17,936
3245	GY380	EM BK W/O M	MAS4	36,667	232	14,727	34,900	.42	COAL	17,936
3246	GY380	EM BK W/O M	MAS4	55,971	314	19,904	47,169	.42	COAL	24,242
3247	GY380	MOTOR REP S	CMU6	8,966				0.00	COAL	8,554
3252	GY380	MOTOR REP S	CMU4	13,874	217	13,792	37,210	.37	COAL	9,705
3254	GY380	MOTOR REP S	CMU4	14,419	236	15,000	40,470	.37	COAL	10,555
3255	GY380	MOTOR REP S	CMU6	9,509				0.00	COAL	8,995
3257	GY380	MOTOR REP S	CMU4	16,964	210	13,302	35,890	.37	COAL	9,361
3265	GY380	OPEN MESS	MAS4	19,585	93	11,133	16,853	.66	NO 2	8,661
3266	GY380	SIG ADM BLD	MAS4	25,178	81	9,633	15,723	.61	NO 2	8,080
3278	GY380	MOTOR REP S	CMU4	15,888	304	36,216	52,062	.69	NO 2	13,579
3700	GY382	HOSPITAL	MAS4	54,476	176	11,172	28,975	.38	COAL	14,891
3701	GY382	GENEDEV/EXC	MAS4	28,156	99	6,284	20,810	.30	COAL	10,695
3702	GY382	EM MD BK	MAS4	58,085	363	23,031	54,580	.42	COAL	28,051
3703	GY382	LABORATORY	MAS4	65,371	196	12,415	32,200	.38	COAL	16,548

Table 3-10. Savings Weatherization Walls, Kaiserslautern (continued)

BLDG	KASERNE	FUNCTION	WALL TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT WALL
3704	GY382	SENTRY STAT	MAS4	4,262	22	2,729	4,815	.56	NO 2	2,474
3705	GY382	EM SERV BLD	MAS4	27,562	100	6,373	21,103	.30	COAL	10,846
3707	GY382	EM MD BK	MAS4	60,201	201	12,748	30,211	.42	COAL	15,526
3716	GY382	EW BK W/O M	MAS4	58,085	363	23,031	54,580	.42	COAL	28,051
3718	GY382	THEAT W/ ST	CONC4	11,758				0.00	COAL	10,060
3720	GY382	GYMNASIUM	MAS1	10,087	211	13,371	31,711	.42	COAL	7,553
3722	GY382	BOWLING CTR	CONC4	26,568				0.00	COAL	10,329
3723	GY382	MOTOR REP S	CMU4	9,230	175	11,101	29,950	.37	COAL	7,811
3724	GY382	MOTOR REP S	MAS3	7,708	95	6,031	20,791	.29	COAL	5,423
3732	GY382	VET FAC	MAS4	9,513	52	3,293	8,542	.38	COAL	4,390
3736	GY382	FIRE STATIO	MAS4	4,793	47	3,005	8,918	.33	COAL	4,583
3737	GY382	FE MNT SHOP	MAS4	6,596	48	3,044	9,588	.31	COAL	4,928
3738	GY382	MEDICAL LAB	MAS4	25,961	92	5,868	15,220	.38	COAL	7,822
3740	GY382	GEN PURP WH	MAS4	29,328	151	9,582	30,546	.31	COAL	15,698
3741	GY382	P O MAIN	CMU4	3,556	77	4,932	12,541	.39	COAL	3,271
3751	GY382	BOQ MIL MAL	MAS4	12,277	115	7,297	17,293	.42	COAL	8,887
3752	GY382	BOQ MIL FEM	MAS4	35,063	202	12,836	30,420	.42	COAL	15,634
3753	GY382	BOQ MIL MAL	MAS4	12,277	115	7,297	17,293	.42	COAL	8,887
3754	GY382	BOQ MIL FEM	MAS4	35,063	202	12,836	30,420	.42	COAL	15,634
3755	GY382	BOQ MIL MAL	MAS4	12,277	115	7,297	17,293	.42	COAL	8,887
3756	GY382	BOQ MIL FEM	MAS4	35,063	202	12,836	30,420	.42	COAL	15,634
3757	GY382	HOSPITAL	MAS3	26,518	396	25,109	71,286	.35	COAL	18,593
3758	GY382	HOSPITAL	MAS3	15,198	243	15,417	43,770	.35	COAL	11,416
3759	GY382	HOSPITAL	MAS3	15,233	243	15,417	43,770	.35	COAL	11,416
3760	GY382	OPS GEN PUR	MAS3	15,619	272	17,253	44,760	.38	COAL	11,674
3761	GY382	HOSPITAL	MAS3	26,518	396	25,109	71,286	.35	COAL	18,593
3762	GY382	HOSPITAL	MAS3	26,518	396	25,109	71,286	.35	COAL	18,593
3763	GY382	HOSPITAL	MAS3	16,000	215	13,659	38,778	.35	COAL	10,114
3763A	GY382	RECOVERY	CONC4	3,009				0.00	COAL	516
3764	GY382	HOSP CLINIC	MAS3	18,000	239	15,184	43,110	.35	COAL	11,244
3765	GY382	OPS GEN PUR	MAS3	36,909	455	28,830	74,793	.38	COAL	19,507
3766	GY382	CLINIC / AD	MAS3	35,102	423	26,808	89,892	.29	COAL	23,446
3767	GY382	HOSP CLINIC	MAS3	32,693	432	27,361	77,680	.35	COAL	20,261
3769	GY382	HOSPITAL	MAS3	14,420	233	14,748	41,872	.35	COAL	10,921
3770	GY382	HOSPITAL	MAS3	15,199	243	15,417	43,770	.35	COAL	11,416
3771	GY382	MNT / CLINI	MAS3	14,420	203	12,889	41,872	.30	COAL	10,921
3772	GY382	HOSPITAL	MAS3	26,518	396	25,109	71,286	.35	COAL	18,593
3774	GY382	EXCH CAFE/O	MAS3	15,523	195	12,362	38,448	.32	COAL	10,028
3775	GY382	ENL PERS ME	MAS4	31,676	217	13,780	39,150	.35	COAL	20,121
3776	GY382	LIBRARY	MAS4	4,719	55	3,506	10,405	.33	COAL	5,347
3780	GY382	OPN MESS OF	MAS3	11,423	142	9,019	28,052	.32	COAL	7,316
3792	GY382	MED ADM BLD	MAS4	12,632	73	4,682	14,341	.32	COAL	7,370
3794	GY382	OPN MESS NC	MAS4	9,571	59	7,080	10,719	.66	NO 2	5,509
3800	GY382	MOTOR REP S	CMU4	5,770	116	7,354	19,843	.37	COAL	5,175
3809	GY382	LAB/ADM/EM	MAS4	72,966	386	24,471	57,993	.42	COAL	29,805
3810	GY382	SCHOOL/ADM/	MAS3	51,821	388	24,604	89,190	.27	COAL	23,263
3812	GY382	CHILD CARE	MAS4	9,114	54	3,470	10,300	.33	COAL	5,293
3813	GY382	EM BK W/O M	MAS4	13,324	82	5,238	12,415	.42	COAL	6,380
3815	GY382	EM BK W/O M	MAS4	13,324	82	5,238	12,415	.42	COAL	6,380
3817	GY382	EXCH WHSE	MAS4	4,868	16	1,044	3,328	.31	COAL	1,710
3818	GY382	BN HQ BLDG	MAS3	9,095	77	4,884	16,377	.29	COAL	4,271
3819	GY382	BLDGS MNT S	MAS3	9,095	99	6,313	16,377	.38	COAL	4,271

Table 3-10. Savings Weatherization Walls, Kaiserslautern (continued)

BLDG	KASERNE	FUNCTION	WALL TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT WALL
3820	GY382	ADM / CLASS	MAS4	13,646	68	4,326	13,252	.32	COAL	6,811
3821	GY382	SEBQ	MAS4	13,035	73	4,638	10,991	.42	COAL	5,649
3823	GY382	SEBQ	MAS4	13,035	73	4,638	10,991	.42	COAL	5,649
3824	GY382	EM BK W/O M	MAS4	14,424	94	6,007	14,236	.42	COAL	7,316
3007	GY455	MOTOR REP S	CMU4	11,559	239	15,168	40,923	.37	COAL	10,673
3008	GY455	MOTOR REP S	CMU4	11,559	239	15,168	40,923	.37	COAL	10,673
3010	GY455	MOTOR REP S	CMU4	7,008	208	13,226	35,684	.37	COAL	9,307
3011	GY455	MOTOR REP S	CMU4	7,008	208	13,226	35,684	.37	COAL	9,307
3012	GY455	MOTOR REP S	CMU4	7,008	208	13,226	35,684	.37	COAL	9,307
3013	GY455	MOTOR REP S	CMU4	11,896	213	13,501	36,427	.37	COAL	9,501
3014	GY455	MRS & RESTR	CMU4	26,516	468	29,660	72,194	.41	COAL	18,830
3016	GY455	VEH PAINT S	CMU4	13,543	173	11,009	29,702	.37	COAL	7,747
3020	GY455	MOTOR REP S	CMU4	7,936	188	11,942	32,219	.37	COAL	8,403
3021	GY455	MOTOR REP S	CMU4	15,650	226	26,860	38,613	.69	NO 2	10,071
3030	GY455	MOTOR REP S	CONC1	10,199	346	21,934	28,960	.75	COAL	7,553
3040	GY455	MTL & WDWK	MAS4	30,311	148	15,101	29,687	.50	NO 6	15,257
3041	GY455	MOTOR REP S	MAS4	36,102	151	15,356	30,190	.50	NO 6	15,515
3042	GY455	MOTOR REP S	MAS1	11,445	186	18,891	29,678	.63	NO 6	7,069
3043	GY455	MOTOR REP S	CMU3	10,438	280	28,492	42,450	.67	NO 6	11,072
3050	GY455	MOTOR REP S	CMU3	7,758	168	17,084	25,453	.67	NO 6	6,638
3051	GY455	MOTOR REP S	CMU3	7,762	168	17,084	25,453	.67	NO 6	6,638
3053	GY455	ORD ADM BLD	CMU3	5,146	112	11,415	16,542	.69	NO 6	4,314
3055	GY455	GEN PURP WH	CMU4	29,996	295	29,958	51,072	.58	NO 6	13,320
3056	GY455	GEN PURP WH	CMU4	29,996	295	29,958	51,072	.58	NO 6	13,320
3057	GY455	ELEC MNT SH	CMU3	19,375	235	23,895	35,602	.67	NO 6	9,28
3058	GY455	PO BRANCH	CMU3	17,988	269	27,325	38,366	.71	NO 6	10,006
3083	GY455	RECR BLDG	CMU4	6,737	142	16,870	22,854	.73	NO 2	5,961
3091	GY455	GEN MNT SHO	MET2	2,166	36	4,292	5,410	.79	NO 2	2,313
3401	GY490	QM REPAIR S	CMU4	35,467	270	27,433	46,204	.59	NO 6	12,051
3402	GY490	GEN PURP WH	MAS3	18,502	287	29,165	63,530	.45	NO 6	16,570
3403	GY490	FIXED LAUND	MAS1	40,631	619	62,856	93,056	.67	NO 6	22,165
3406	GY490	GEN PURP WH	CMU3	61,637	699	70,960	107,012	.66	NO 6	27,911
3408	GY490	CALIBR & RE	MAS4	17,819	121	14,473	24,286	.59	NO 2	12,481
3413	GY490	SUP SVC ADM	MAS4	16,320	88	10,570	17,251	.61	NO 2	8,866
3424	GY490	QM REPAIR S	CMU4	4,425	162	16,460	27,722	.59	NO 6	7,230
110	GY542	POST RESTAU	WD1	3,850				0.00	NO 2	3,421
162	GY542	EM BK / BN	MAS4	41,949	230	27,397	34,595	.79	NO 2	17,779
163	GY542	ENL PERS ME	MAS2	9,296	91	10,862	11,745	.92	NO 2	6,036
164	GY542	ADM BLDG (A	MAS4	41,949	178	21,196	34,595	.61	NO 2	17,779
175	GY542	MOTOR REP S	MAS2	10,280	116	13,799	16,539	.83	NO 2	8,500
176	GY542	EXCH CAFE	MAS4	2,384	31	1,982	4,698	.42	COAL	2,414
179	GY542	GP HQ BLDG	MAS2	21,256	152	18,102	21,103	.85	NO 2	10,846
270	GY542	OPS GEN PUR	MAS2	5,380	47	5,681	7,160	.79	NO 2	3,679
273	GY542	EM BK W/O M	MAS2	6,193	79	5,061	8,567	.59	COAL	4,402
274	GY542	EM BK W/O M	MAS2	6,193	60	3,834	6,490	.59	COAL	3,335
275	GY542	EMM BK W/O	MAS2	6,193	79	5,061	8,567	.59	COAL	4,402
276	GY542	CO HQ BLDG	MAS2	4,659	63	4,038	8,835	.45	COAL	4,540
277	GY542	CO HQ BLDG	MAS2	4,659	63	4,038	8,835	.45	COAL	4,540
278	GY542	EM BK W/O M	MAS2	6,193	79	5,061	8,567	.59	COAL	4,402
279	GY542	EM BK W/O M	MAS2	6,193	60	3,834	6,490	.59	COAL	3,335
280	GY542	E BK W/O MS	MAS2	6,193	79	5,061	8,567	.59	COAL	4,402
281	GY542	CO HQ BLDG	MAS2	4,659	63	4,038	8,835	.45	COAL	4,540

Table 3-10. Savings Weatherization Walls, Kaiserslautern (continued)

BLDG	KASERNE	FUNCTION	WALL TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT WALL
282	GY542	EM BK W/O M	MAS2	6,193	79	5,061	8,567	.59	COAL	4,402
283	GY542	EM BK W/O M	MAS2	6,193	60	3,834	6,490	.59	COAL	3,335
284	GY542	EM BK W/O M	MAS2	6,193	79	5,061	8,567	.59	COAL	4,402
285	GY542	GEN INST BL	MAS2	3,400	35	2,265	5,359	.42	COAL	2,754
286	GY542	ADM GEN PUR	MAS2	3,400	38	2,449	5,359	.45	COAL	2,754
288	GY542	ADM GEN PUR	MAS2	3,035	32	2,038	4,459	.45	COAL	2,291
289	GY542	EM BK W/O M	MAS2	6,505	104	6,592	11,159	.59	COAL	5,735
290	GY542	MNT SHOP	MAS2	2,110	31	1,982	4,459	.44	COAL	2,291
291	GY542	GEN STOREHO	CONC2	5,800	121	14,377	14,636	.98	NO 2	3,486
292	GY542	CO HQ BLDG	MAS2	3,943	48	3,100	6,783	.45	COAL	3,486
326	GY542	ELEC MNT SH	MAS1	3,875	71	8,489	11,383	.74	NO 2	2,711
331	GY542	GEN STOREHO	CMU3	3,875	67	8,076	10,395	.77	NO 2	2,711
332	GY542	GEN STOREHO	CMU3	3,875	67	8,076	10,395	.77	NO 2	2,711
335	GY542	GEN STOREHO	CMU3	3,875	67	8,076	10,395	.77	NO 2	2,711
336	GY542	GEN STOREHO	CMU3	3,875	67	8,076	10,395	.77	NO 2	2,711
337	GY542	ADM GEN PUR	MAS1	3,875	73	8,728	11,383	.76	NO 2	2,711
339	GY542	GEN STOREHO	CMU3	3,875	67	8,076	10,395	.77	NO 2	2,711
344	GY542	GEN STOREHO	CMU3	3,875	67	8,076	10,395	.77	NO 2	2,711
346	GY542	GEN STOREHO	CMU3	3,875	67	8,076	10,395	.77	NO 2	2,711
347	GY542	SM ARMS REP	CONC4	4,197				0.00	NO 2	2,823
369	GY542	MOTOR REP S	MET4	3,400				0.00	NO 2	3,137
370	GY542	MOTOR REP S	MET4	3,400				0.00	NO 2	3,137
371	GY542	MOTOR REP S	MET4	3,400				0.00	NO 2	3,137
372	GY542	MTL & WDWK	MET3	3,400				0.00	NO 2	3,137
394	GY542	MOTOR REP S	MAS1	10,543	272	32,340	43,366	.74	NO 2	10,329
395	GY542	MOTOR REP S	MAS1	10,543	272	32,340	43,366	.74	NO 2	10,329
611	GY542	MSL ASY & T	CONC4	21,736				0.00	NO 2	12,330
622	GY542	MOTOR REP S	MET5	3,228				0.00	NO 2	3,534
630	GY542	AMMO RENV S	CONC3	13,803	203	24,123	44,141	.54	NO 2	11,513
637	GY542	WTNG SHELTE	MET2	5,046	94	11,239	14,897	.75	NO 2	6,369
701	GY542	AMMO RENV S	MAS2	3,388	42	5,074	6,082	.83	NO 2	3,125
705	GY542	ADM GEN PUR	MAS2	2,010	30	3,645	4,250	.85	NO 2	2,184
3000	GY565	WAREHOUSE	MAS4	11,340	71	4,551	14,508	.31	COAL	7,456
3006	GY565	MOTOR REPAI	CMU3	4,965	105	6,672	15,923	.41	COAL	4,153
3009	GY565	MOTOR REPAI	CMU3	3,872	100	6,343	15,140	.41	COAL	3,948
3100	GY680	EM BK W/O M	MAS4	57,645	168	20,029	25,291	.79	NO 2	12,998
3101	GY680	ADM & SUP /	MAS4	55,014	204	24,240	30,608	.79	NO 2	15,731
3102	GY680	EM BK W/O M	MAS4	55,014	204	24,240	30,608	.79	NO 2	15,731
3103	GY680	EM BK W/O M	MAS4	55,014	204	24,240	30,608	.79	NO 2	15,731
3104	GY680	ADM GEN PUR	MAS4	60,278	173	20,627	33,665	.61	NO 2	17,302
3106	GY680	ENL PERS ME	MAS4	27,550	100	11,990	18,151	.66	NO 2	9,328
3107	GY680	ADM GEN PUR	MAS4	27,550	93	11,121	18,151	.61	NO 2	9,328
3113	GY680	FE FAC	WD1	5,061				0.00	NO 2	5,100
3114	GY680	MOTOR REP S	CMU3	10,659	184	18,745	27,928	.67	NO 6	7,284
3115	GY680	SKILL DEV G	WD1	3,170				0.00	NO 6	3,217
3116	GY680	MOTOR REP S	CMU3	10,842	184	18,745	27,928	.67	NO 6	7,284
3117	GY680	MOTOR REP S	CMU3	13,695	122	12,432	18,522	.67	NO 6	4,831
3150	GY741	POST CHAPEL	MAS3	12,665	190	22,640	39,191	.57	NO 2	10,222
2861	GY744	EM BK W/O M	CMU3	15,870	311	19,719	35,416	.55	COAL	9,237
2862	GY744	CO HQ BLDG	MAS4	3,943	37	2,362	7,235	.32	COAL	3,718
2863	GY744	EM BK W/O M	CMU3	15,870	311	19,719	35,416	.55	COAL	9,237
2864	GY744	POST RESTAU	MAS4	3,943	36	2,280	6,478	.35	COAL	3,329

Table 3-10. Savings Weatherization Walls, Kaiserslautern (continued)

BLDG	KASERNE	FUNCTION	WALL TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT WALL
2865	GY744	EM BK W/O M	CMU3	15,870	311	19,719	35,416	.55	COAL	9,237
2866	GY744	CO HQ BLDG	MAS4	3,943	33	2,116	6,483	.32	COAL	3,332
2867	GY744	EM BK W/O M	CMU3	10,585	250	15,885	28,531	.55	COAL	7,441
2868	GY744	ENL PERS ME	CMU4	10,751	61	3,898	9,488	.41	COAL	2,474
2869	GY744	MORGUE	MAS4	6,926	37	4,402	6,084	.72	NO 2	3,126
2872	GY744	GEN PURP WH	MAS3	3,622	58	5,920	12,895	.45	NO 6	3,363
2874	GY744	EM BK W/O M	MAS3	18,489	545	55,335	89,615	.61	NO 6	23,373
2876	GY744	CO HQ BLDG	MAS3	4,659	93	9,452	19,785	.47	NO 6	5,160
2877	GY744	GEN STOREHO	CONC2	3,403	124	12,609	15,038	.83	NO 6	3,582
2879	GY744	EM BK W/O M	MAS3	18,468	545	55,335	89,615	.61	NO 6	23,373
2880	GY744	CO HQ BLDG	MAS3	4,659	93	9,452	19,785	.47	NO 6	5,160
2882	GY744	RECR BLDG	CONC2	3,403	133	13,543	15,038	.90	NO 6	3,582
2885	GY744	UNIT CHAPEL	WD1	2,580				0.00	COAL	2,012
2886	GY744	EM BK W/O M	MAS3	18,468	545	55,335	89,615	.61	NO 6	23,373
2887	GY744	CO HQ BLDG	MAS3	4,781	94	9,586	20,065	.47	NO 6	5,233
2890	GY744	EM BK W/O M	MAS3	18,468	545	55,335	89,615	.61	NO 6	23,373
2891	GY744	CO HQ BLDG	MAS3	4,659	96	9,735	20,379	.47	NO 6	5,315
2895	GY744	ENL PER MES	CMU4	18,400	140	14,199	21,575	.65	NO 6	5,627
2897	GY744	ADM GEN PUR	WD1	6,723				0.00	NO 2	5,286
2898	GY744	VET FAC	MAS3	2,127	36	3,747	6,641	.56	NO 6	1,732
2899	GY744	SP SVC OFF	WD1	2,867				0.00	NO 6	2,012
2901	GY744	THRIFT SHOP	MAS3	2,127	32	3,275	6,641	.49	NO 6	1,732
2902	GY744	MOTOR REP S	CMU4	4,929	86	8,781	14,789	.59	NO 6	3,857
2909	GY744	GEN STOREHO	CMU3	2,180	58	5,897	8,894	.66	NO 6	2,319
2910	GY744	GEN STOREHO	CMU3	2,180	58	5,897	8,894	.66	NO 6	2,319
2911	GY744	GEN STOREHO	CMU3	2,180	58	5,897	8,894	.66	NO 6	2,319
2912	GY744	GEN STOREHO	CMU3	2,180	58	5,897	8,894	.66	NO 6	2,319
2913	GY744	CO HQ BLDG	MAS3	2,127	31	3,173	6,641	.47	NO 6	1,732
2915	GY744	CO HQ BLDG	MAS3	2,127	31	3,173	6,641	.47	NO 6	1,732
2917	GY744	DISP W/ BED	MAS2	6,588	91	9,269	10,719	.86	NO 6	5,509
2918	GY744	BOQ MIL MAL	MAS2	6,588	100	10,144	10,719	.94	NO 6	5,509
2919	GY744	BOQ MIL MAL	MAS2	6,588	100	10,144	10,719	.94	NO 6	5,509
2921	GY744	BOQ MIL MAL	MAS2	6,588	100	10,144	10,719	.94	NO 6	5,509
2922	GY744	BOQ MIL MAL	MAS2	6,588	100	10,144	10,719	.94	NO 6	5,509
2923	GY744	CO HQ BLDG	MAS3	4,659	93	9,459	19,801	.47	NO 6	5,164
2925	GY744	EM BK W/O M	MAS3	18,468	545	55,328	89,603	.61	NO 6	23,370
2926	GY744	CO HQ BLDG	MAS3	4,659	93	5,905	19,801	.29	COAL	5,164
2928	GY744	EM BK W/O M	MAS3	18,468	545	55,335	89,615	.61	NO 6	23,373
2929	GY744	CO HQ BLDG	MAS3	4,659	93	9,459	19,801	.47	NO 6	5,164
2930	GY744	EM BK W/O M	MAS3	18,468	545	55,335	89,615	.61	NO 6	23,373
2932	GY744	GEN INST BL	MAS3	4,659	93	9,459	19,801	.47	NO 6	5,164
2933	GY744	ADM GEN PUR	MAS3	12,326	130	13,184	27,598	.47	NO 6	7,198
2934	GY744	ADM (BANK)	CMU4	4,659	119	12,087	19,801	.61	NO 6	5,164
2935	GY744	XMTR BLDG/A	MAS1	12,326	195	19,777	30,220	.65	NO 6	7,198
2942	GY744	MOTOR REP S	MET2	4,231	62	7,386	9,310	.79	NO 2	3,981

TOTAL ANNUAL HEAT SAVINGS MBTU	49,108
TOTAL DOLLAR SAVINGS	4,268,630
TOTAL COST	8,056,817
TOTAL SQFT	5,287,570
TOTAL SQFT WALLS	3,010,25
PEAK LOAD REDUCTION	17,014,547

Table 3-11. Savings Weatherization Roofs, Kaiserslautern

BLDG	KASERNE	FUNCTION	ROOF TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT ROOF
2202	GY298	ADM GEN PUR	RF21	3,538	28	2,879	14,780	.19	NO 6	3,536
2233A	GY298	ENG FLD MNT	RF23	99,785	519	52,705	110,832	.47	NO 6	76,073
2264	GY298	GEN PURP WH	RF24	39,259	695	70,488	85,218	.82	NO 6	40,048
2270	GY298	POST RESTAU	RF21	3,442	29	3,021	14,389	.21	NO 6	3,443
2277	GY298	MNT SH WHSE	RF24	10,070	178	18,078	21,856	.82	NO 6	10,271
2280	GY298	GEN PURP WH	RF23	11,538	79	8,057	17,150	.46	NO 6	11,771
2363	GY298	CARE & PRES	RF24	12,366	222	14,058	26,898	.52	COAL	12,640
2370	GY298	GEN PURP WH	RF6	76,064	374	44,536	84,958	.52	NO 2	77,751
2371A	GY298	GEN PURP WH	RF6	59,333	292	29,654	66,276	.44	NO 6	60,654
2371B	GY298	GEN PURP WH	RF6	59,333	292	29,654	66,276	.44	NO 6	60,654
2372A	GY298	GEN PURP WH	RF6	56,946	279	28,318	63,289	.44	NO 6	57,921
2372B	GY298	GEN PURP WH	RF6	56,946	279	28,318	63,289	.44	NO 6	57,921
2393	GY298	MOTOR REP S	RF23	32,224	225	22,819	47,985	.47	NO 6	32,936
3183	GY374	BAND TNG FA	RF13	6,989	45	5,393	7,500	.71	NO 2	6,986
3201	GY380	DISP W/O BE	RF10	19,317				0.00	COAL	6,832
3231	GY380	BOWLING CTR	RF13	30,596	125	7,930	18,551	.42	COAL	17,280
3235	GY380	GYMNASIUM	RF30	22,029	506	32,049	111,597	.28	COAL	22,219
3247	GY380	MOTOR REP S	RF23	8,966	61	3,895	13,121	.29	COAL	9,006
3255	GY380	MOTOR REP S	RF23	9,509	64	4,113	13,857	.29	COAL	9,511
3257	GY380	MOTOR REP S	RF4	16,964	314	19,920	20,789	.95	COAL	9,770
3278	GY380	MOTOR REP S	RF23	15,888	113	13,485	24,204	.55	NO 2	16,613
3718	GY382	THEAT W/ ST	RF21	11,758	97	6,163	49,103	.12	COAL	11,749
3719	GY382	GEN STOREHO	RF24	8,002	148	9,375	18,156	.51	COAL	8,532
3720	GY382	GYMNASIUM	RF9	10,087	268	16,984	22,048	.77	COAL	10,361
3723	GY382	MOTOR REP S	RF17	9,230	171	10,831	12,735	.85	COAL	9,226
3724	GY382	MOTOR REP S	RF9	7,708	189	11,966	16,485	.72	COAL	7,747
3740	GY382	GEN PURP WH	RF9	29,328	708	44,876	62,574	.71	COAL	29,407
3751	GY382	BOQ MIL MAL	RF13	12,277	55	3,524	6,584	.53	COAL	6,133
3753	GY382	BOQ MIL MAL	RF13	12,277	55	3,524	6,584	.53	COAL	6,133
3755	GY382	BOQ MIL MAL	RF13	12,277	55	3,524	6,584	.53	COAL	6,133
3763A	GY382	RECOVERY	RF27	3,009				0.00	COAL	3,012
3774	GY382	EXCH CAFE/O	RF30	15,523	369	23,377	77,929	.29	COAL	15,515
3775	GY382	ENL PERS ME	RF30	31,676	755	47,825	159,425	.29	COAL	31,742
3810	GY382	SCHOOL/ADM/	RF4	51,821	534	33,862	37,160	.91	COAL	17,463
3817	GY382	EXCH WHSE	RF22	4,868	103	6,531	10,348	.63	COAL	4,863
3818	GY382	BN HQ BLDG	RF13	9,095	31	2,019	4,874	.41	COAL	4,540
3819	GY382	BLDGS MNT S	RF13	9,095	41	2,609	4,874	.53	COAL	4,540
3016	GY455	VEH PAINT S	RF22	13,543	300	18,999	29,741	.63	COAL	13,977
3020	GY455	MOTOR REP S	RF24	7,936	148	9,381	17,950	.52	COAL	8,435
3021	GY455	MOTOR REP S	RF24	15,650	285	33,957	34,618	.98	NO 2	16,269
3030	GY455	MOTOR REP S	RF23	10,199	73	4,663	15,707	.29	COAL	10,781
3040	GY455	MTL & WDWK	RF8	30,311	532	54,041	68,344	.79	NO 6	32,118
3041	GY455	MOTOR REP S	RF8	36,102	622	63,093	79,792	.79	NO 6	37,498
3055	GY455	GEN PURP WH	RF8	29,996	514	52,120	66,718	.78	NO 6	31,354
3056	GY455	GEN PURP WH	RF8	29,996	514	52,120	66,718	.78	NO 6	31,354
3402	GY490	GEN PURP WH	RF21	18,502	160	16,320	87,190	.18	NO 6	20,863
150	GY542	GEN PURP WH	RF23	41,667	282	33,617	61,075	.55	NO 2	41,920
175	GY542	MOTOR REP S	RF24	10,280	184	21,919	22,346	.98	NO 2	10,501
176	GY542	EXCH CAFE	RF13	2,384	21	1,366	2,552	.53	COAL	2,377
273	GY542	EM BK W/O M	RF13	6,193	28	1,781	3,326	.53	COAL	3,098
274	GY542	EM BK W/O M	RF13	6,193	28	1,781	3,326	.53	COAL	3,098
275	GY542	EMM BK W/O	RF13	6,193	28	1,781	3,326	.53	COAL	3,098

Table 3-11. Savings Weatherization Roofs, Kaiserslautern (continued)

BLDG	KASERNE	FUNCTION	ROOF TYPE	SQFT BLDG	SAVINGS MBTU	SAVINGS US$	COST US$	SIR	FUEL TYPE	SQFT ROOF
276	GY542	CO HQ BLDG	RF13	4,659	19	1,205	2,910	.41	COAL	2,711
277	GY542	CO HQ BLDG	RF13	4,659	19	1,205	2,910	.41	COAL	2,711
278	GY542	EM BK W/O M	RF13	6,193	28	1,781	3,326	.53	COAL	3,098
279	GY542	EM BK W/O M	RF13	6,193	28	1,781	3,326	.53	COAL	3,098
280	GY542	E BK W/O MS	RF13	6,193	28	1,781	3,326	.53	COAL	3,098
281	GY542	CO HQ BLDG	RF13	4,659	19	1,205	2,910	.41	COAL	2,711
282	GY542	EM BK W/O M	RF13	6,193	28	1,781	3,326	.53	COAL	3,098
283	GY542	EM BK W/O M	RF13	6,193	28	1,781	3,326	.53	COAL	3,098
284	GY542	EM BK W/O M	RF13	6,193	28	1,781	3,326	.53	COAL	3,098
285	GY542	GEN INST BL	RF13	3,400	22	1,398	3,650	.38	COAL	3,400
286	GY542	ADM GEN PUR	RF13	3,400	23	1,511	3,650	.41	COAL	3,400
288	GY542	ADM GEN PUR	RF13	3,035	21	1,349	3,257	.41	COAL	3,034
289	GY542	EM BK W/O M	RF13	6,505	29	1,867	3,488	.53	COAL	3,249
290	GY542	MNT SHOP	RF13	2,110	14	912	2,264	.40	COAL	2,108
291	GY542	GEN STOREHO	RF13	5,800	39	4,650	6,226	.74	NO 2	5,799
326	GY542	ELEC MNT SH	RF21	3,875	30	3,593	16,188	.22	NO 2	3,873
347	GY542	SM ARMS REP	RF27	4,197				0.00	NO 2	4,196
611	GY542	MSL ASY & T	RF28	21,736				0.00	NO 2	21,724
622	GY542	MOTOR REP S	RF28	3,228				0.00	NO 2	3,303
630	GY542	AMMO RENV S	RF26	13,803				0.00	NO 2	14,106
695	GY542	CHEMISTRY L	RF28	4,595				0.00	NO 2	4,648
701	GY542	AMMO RENV S	RF21	3,388	26	3,144	14,164	.22	NO 2	3,389
705	GY542	ADM GEN PUR	RF21	2,010	16	1,919	8,408	.22	NO 2	2,012
3019	GY565	ADM GEN PUR	RF4	2,815	97	6,157	6,250	.98	COAL	2,937
3150	GY741	POST CHAPEL	RF30	12,665	288	34,284	63,608	.53	NO 2	12,664
2859	GY744	MOTOR REP S	RF8	11,111	193	12,251	24,819	.49	COAL	11,663
2868	GY744	ENL PERS ME	RF17	10,751	110	6,986	7,410	.94	COAL	5,369
2876	GY744	CO HQ BLDG	RF21	4,659	21	2,207	11,331	.19	NO 6	2,711
2877	GY744	GEN STOREHO	RF13	3,403	22	2,327	3,650	.63	NO 6	3,400
2880	GY744	CO HQ BLDG	RF21	4,659	21	2,207	11,331	.19	NO 6	2,711
2882	GY744	RECR BLDG	RF21	3,403	28	2,856	14,209	.20	NO 6	3,400
2887	GY744	CO HQ BLDG	RF21	4,781	21	2,207	11,331	.19	NO 6	2,711
2891	GY744	CO HQ BLDG	RF21	4,659	21	2,207	11,331	.19	NO 6	2,711
2898	GY744	VET FAC	RF13	2,127	17	1,792	2,287	.78	NO 6	2,130
2899	GY744	SP SVC OFF	RF28	2,867				0.00	NO 6	2,862
2901	GY744	THRIFT SHOP	RF13	2,127	15	1,563	2,282	.68	NO 6	2,126
2913	GY744	CO HQ BLDG	RF21	2,127	17	1,734	8,903	.19	NO 6	2,130
2915	GY744	CO HQ BLDG	RF21	2,127	17	1,734	8,903	.19	NO 6	2,130
2923	GY744	CO HQ BLDG	RF21	4,659	21	2,207	11,331	.19	NO 6	2,711
2926	GY744	CO HQ BLDG	RF21	4,659	21	1,377	11,331	.12	COAL	2,711
2929	GY744	CO HQ BLDG	RF21	4,659	21	2,207	11,331	.19	NO 6	2,711
2932	GY744	GEN INST BL	RF21	4,659	21	2,207	11,331	.19	NO 6	2,711
2934	GY744	ADM (BANK)	RF21	4,659	21	2,207	11,331	.19	NO 6	2,711
2942	GY744	MOTOR REP S	RF6	4,231	20	2,482	4,679	.53	NO 2	4,282

TOTAL ANNUAL HEAT SAVINGS MBTU	13,513
TOTAL DOLLAR SAVINGS	1,161,180
TOTAL COST	2,290,008
TOTAL SQFT	1,388,302
TOTAL SQFT ROOFS	1,232,176
PEAK LOAD REDUCTION	4,718,109

3.3.8.6. Zone existing multiple use facilities to reduce energy consumption in minimal use areas.

This has been accomplished where feasible.

3.3.8.7. Reschedule utilization of existing facilities.

This is not feasible.

3.3.8.8. Consolidate services into permanent buildings through alteration or new construction.

This is included in future development plan.

3.3.8.9. Connect to district heating in order to purchase or sell energy.

See 7.11.

3.3.8.10. Interconnect existing power plants.

Not feasible.

3.3.8.11. Consolidate existing power plants where forecastable non-recurring maintenance costs can be demonstrated.

Boilers are refurbished by community.

3.3.8.12. Convert to more energy efficient fuels.

This is being done where feasible.

3.3.8.13. Return condensate.

All condensate is returned.

3.3.8.14. Convert existing energy distribution systems to utilize more efficient medium.

This is being done where feasible.

3.3.8.15. Supplement the generation of domestic hot water through installation of a heat pump.

Not feasible.

3.3.8.16. Decentralize domestic hot water heaters.

They are decentralized.

3.3.8.17. Control light levels automatically.

Variation in external luminance is insufficient to warrant automatic adjustment.

3.3.8.18. Employ spot heating in lieu of existing unit heaters.

Spot heating is not applicable to function.

3.3.8.19. Individual versus stairwell or area metering of military family housing.

There is no family housing.

3.3.8.20. Recommended preventive maintenance program procedures for high efficiency motor replacement.

There are no low efficiency motors.

3.3.8.21. Install storm or energy efficient windows, double glaze existing windows, reduce window area, install translucent panels, upgrade by replacement, install thermal barriers, modify skylights.

Not economically feasible.

3.3.8.22. Replace existing doors, install vestibules, air curtains and load dock seals.

New doors have been programmed where economically feasible.

3.4. Recommendations, Policy Changes and Actions.

3.4.1. Recommendations and Policy Changes.

Future consumption of energy can be reduced dramatically even with the addition of the future facilities planned in the future development plan. Careful attention should be given to operational improvements and inoperative controls. While the savings are not quantified, substantial energy savings can be realized by attention to these items.

3.4.2. Actions.

The ECIP and maintenance and repair projects should be implemented. The non-specific maintenance and repair projects should be implemented. The operational maintenance and repair program should be improved. The inoperative controls should be repaired.

4. ENERGY AND COST SAVINGS

4.1. Energy Consumption Forecast.

Assuming that energy conservation projects are implemented by Spring 1987, the first fiscal year to show the results of the projects would be FY 88 when heating fuel consumption would be reduced from the level of 857,250 MBTU/YR to 458,961 This would be a reduction of 46.5 percent. Electricity consumption would be reduced by only 2,610 MWHR per year from the FY 87 level of 46,970 MWH to 44,360, a decrease of 0.56 percent. Total energy consumption would be 973,537 MBTU.

Total Consumption/SQFT = 973,537/6.5 = 149,775 BTU/SF.

See Figure 4-1.

4.2. Forecast Energy Savings.

If the projects proposed in this report are implemented, energy consumption at Kaiserslautern will be reduced as follows:

HEATING/FUEL	MBTU/YR	$/YR
Weatherization	167,701	826,642
Heating System Modifications	185,343	904,243
EMCS	41,520	301,925
Maintenance & Repair Projects	3,825	17,866
TOTAL	398,289	2,050,676
ELECTRICITY	MWHRS/YR	$/YR
Lighting System Modifications	2,610	143,518

ENERGY CONSUMPTION

KAISERLAUTERN COMMUNITY

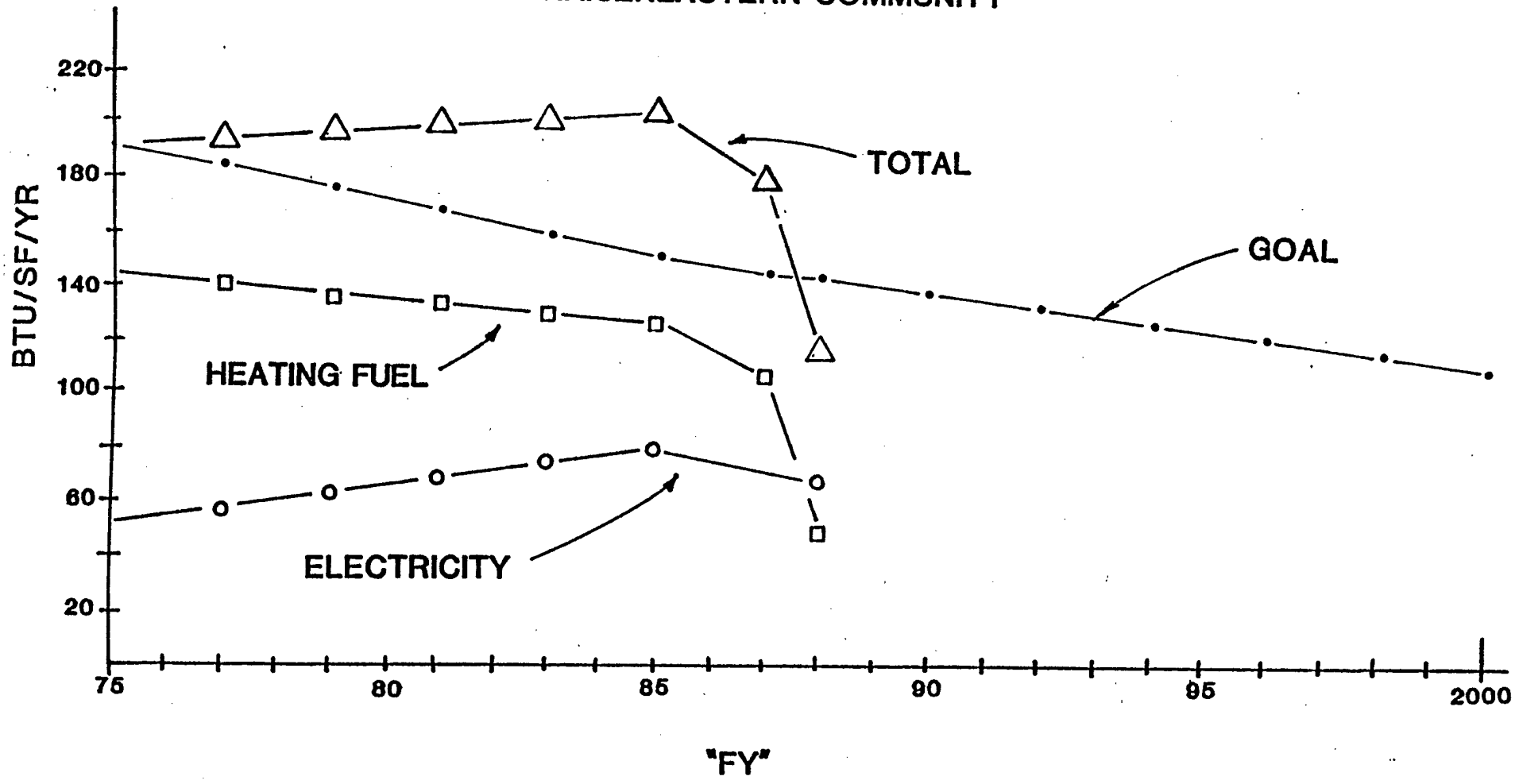

DIAGRAM 4-1

4.3. ECIP Projects.

INCREMENT	TITLE	COST	ANNUAL SAVINGS MBTU	$US	SIR
A	Heating Systems Mod.	806,790	185,243	904,937	14.9
A	Lighting System Mod.	1,163,065	30,278	206,575	1.95
B	EMCS	1,830,428	41,520	310,925	1.9
A	Weatherization	6,741,355	167,701	826,642	1.61

4.4. Projected Utility Costs.

The costs have escalated an average of approximately six percent per year since FY 75, which results in a current average of 4.25$/MBTU for thermal and 3.16$/MBTU for electrical energy. No separate records for different fuels are available. It is reasonable to assume that this average increase will be sustained in the short term.

4.5. Schedule of Energy Conservation Projects.

4.5.1. ECIP Projects.

INCREMENT	TITLE	COST	ANNUAL SAVINGS MBTU	$US	SIR
A	Weatherization	6,741,355	167,701	826,642	1.61
A	Heating Systems Mod.	806,790	185,243	904,937	14.9
A	Lighting System Mod.	1,163,065	30,278	206,575	1.95
B	EMCS	1,830,428	41,520	310,925	1.9

4.5.2. Increment 'F' - Maintenance and Repair Projects.

PROJECT	SEE PARA	$COST	ANNUAL SAVINGS MBTU	US$	SIR
Boiler Plant No. 3403	7.1.1.4.	3,224	137	1,046	3.87
Boiler Plant No. 3054	7.1.1.3.	3,224	90.35	689	2.40

(continued)

PROJECT	SEE PARA	$COST	ANNUAL SAVINGS MBTU	US$	SIR
Heat Recovery Building No. 3266	7.1.2.3.	6,474	113	1,180	1.5
Boiler Plant No. 2211	7.1.1.1.	34,500	1,108	5,252	1.28
Boiler Plant No. 3777	7.1.1.2.	129,000	2,377	9,771	1.06
TOTAL		176,422	3,825.35	17,866	

5. SUMMARY AND CONCLUSIONS

5.1. Summary.

The purpose of this study is to identify and financially evaluate all possible means to reduce energy consumption in compliance with the objectives set forth in the Army Facilities Energy Plan. During the first phase of the study, working with the "Building Information Schedule" (BIS), the Project Manager, Community Representative and Contractor identified a group of buildings to be physically surveyed in detail. This "sample" was to provide a basis for calculation of costs/savings proposed for similar facilities at the community.

Beginning 1 February 1983, a team consisting of an architect, mechanical engineer and electrical engineer, inspected the designated buildings. They also "walked thru" the remaining energy consuming buildings in the Community. Buildings which have no utilities such as storage shelters, or were considered small consumers (less than 2,000 square feet) were neither "surveyed" nor "walked thru". The difference between the two types of inspections is the amount of information collected. This report addresses possible energy conservation measures that should be implemented.

The Kaiserslautern Military Community consists of 13 GYs located in and nearby the City of Kaiserslautern. This community is the home of the Headquarters of the 21st Support Command, Landstuhl Medical Center, and provides a broad range of functions including vehicle maintenance, ordnance storage, communications, logistics and troop housing. GY 732, LAMC SATCOM and Heliport, GY 365 - Hill 365 and AFN Sembach were excluded from this survey because they have little manageable energy consumption.

The Kaiserslautern Community has consumed the following amount of fuel during the fiscal year of 1982 (FY 82).

	MBTU	%	$/MBTU	$	%
Thermal Energy:					
- Oil No. 2	184,783	(14.2)	10.45	1,930,982	(23.0)
- Oil No. 6	204,861	(15.6)	7.63	1,563,089	(18.6)
- Coal	467,606	(36.2)	4.11	1,921,861	(22.9)
TOTAL	857,250	(66.0)	22.19	5,415,932	(64.5)
Electrical Energy:	443,282	(34.0)	4.74	2,101,157	(25.2)
TOTAL	1,300,532	(100.0)		7,517,089	(89.7)
Electrical Demand Charges:	12,353 kW		$70./kW	64,710	(10.3)
GRAND TOTAL				8,381,799	(100.0)

5.2. Conclusions.

The Army Energy Plan's goal for 1985 is a reduction in total energy consumption of 20 percent of FY 75 consumption and a further reduction of 20 percent by FY 2000.

Kaiserslautern FY 75 consumption was 1,240,380/6.5 = 190,828 BTU/SF/YR

The goals would then be:

FY 1985 - 152,662

FY 2000 - 114,496

Kaiserslautern will not meet the FY 85 goal.

After implementation of ECIP projects, consumption will be 67 percent of FY 75 and will require a further reduction of 7 percent to achieve the FY 2000 goal.